

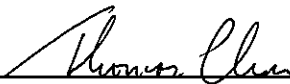
MTR Corporation Limited

South Island Line (East)

Construction Noise Mitigation Measures Plan

January 2012

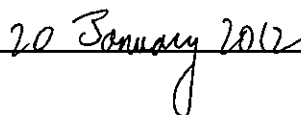
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Independent Environmental Checker

Date:



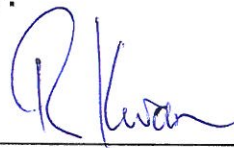
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Certified by:

A handwritten signature in blue ink, appearing to read 'R Kwan', is written over a horizontal line.

Richard Kwan

Environmental Team Leader

Date:

20 JAN 2012

MTR Corporation Limited

# Construction Noise Mitigation Measures Plan for SIL(E)

January 2012

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MTR Corporation Limited

## Construction Noise Mitigation Measures Plan for SIL(E)

January 2012

Reference 0132172

For and on behalf of ERM-Hong Kong, Limited
Approved by: <u>Frank Wan</u>
Signed: <u></u>
Position: <u>Partner</u>
Date: <u>17 January 2012</u>

This report has been prepared by ERM-Hong Kong, Limited with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

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## 1.1 BACKGROUND OF THE PROJECT

The MTR Corporation Limited (MTRCL) commissioned a comprehensive multi-disciplinary preliminary design study for the South Island Line (East) (hereinafter called SIL(E)) in February 2008, following the decision by the Hong Kong SAR Government to proceed with further planning and preparation work for the SIL(E). The SIL(E) is a new extension connecting the existing Island Line and Tsuen Wan Line from Admiralty to the Southern District of Hong Kong.

The SIL(E) is about 7km long and is a medium capacity railway with stations at South Horizons (SOH), Lei Tung (LET), Wong Chuk Hang (WCH), Ocean Park (OCP) and Admiralty (ADM), comprising underground and elevated structures. The integrated ADM station provides a convenient interchange amongst SIL(E), Shatin Central Link (SCL(NSL)), the existing Tsuen Wan Line (TWL) and the Island Line (ISL). A depot is required at Wong Chuk Hang to provide maintenance support for the SIL(E) with property development above.

The SIL(E) EIA report<sup>[1]</sup> was approved with conditions on 26 October 2010 with an Environmental Permit (EP No.: EP-407/2010) granted to the Project Proponent on 8 December 2010. A Variation of EP (EP No.: EP-407/2010/A) was granted to the Project Proponent on 14 December 2011.

## 1.2 PURPOSE OF THIS SUBMISSION

This Construction Noise Mitigation Measures Plan (CNMMP) is submitted to fulfil the requirements under EP Condition 2.9 pertaining to further reduce the construction noise impacts on the 12 noise sensitive receivers (NSRs) with predicted exceedance in air-borne construction noise and the 2 NSRs with predicted exceedance in ground-borne construction noise described in the approved EIA Report arising from the construction of the SIL(E).

To fulfil the requirements of EP Condition 2.9, the following required information has been included in this Plan (sub-divided for individual Contracts in *Annexes A to D* prepared in association with the Contractors that undertake the actual works):

- (a) schedule of construction works to be carried out at the works areas of the Project within 300m from the NSRs;
- (b) updated construction methodology of the construction works;

[1] South Island Line (East) Environmental Impact Assessment Report (Register No.: AEIAR-155/2010) (SIL(E) EIA Report)

- (c) updated powered mechanical equipment (PME) list for the construction works;
- (d) updated proposal of air-borne noise mitigation measures for the 12 NSRs as shown in Figures 3 to 6 of the EP, including the provision of noise barriers, enclosures and Indirect Technical Remedies;
- (e) updated proposal of ground-borne noise mitigation measures for the 2 NSRs as shown in Figure 5 of the EP; and
- (f) updated prediction of noise levels in accordance with the above updated information and mitigation proposals in place.

The CNMMP prepared for Contract No. 903 (Ocean Park Station, Wong Chuk Hang Station, Viaduct and Aberdeen Channel Bridge), Contract No. 907 (Wong Chuk Hang Depot Site Formation and Piling), and Contract No. 904 (Lei Tung Station & South Horizons Station and Tunnels) is given in *Annexes A to D*, respectively.

A summary comparing all the 12 NSRs with predicted exceedance in air-borne construction noise and the 2 NSRs with predicted exceedance in ground-borne construction noise under both the EIA assessed scenario and the revised scenario assessed in the CNMMP is given in *Table 2.1*.

**Table 2.1** *Summary of Results*

NSR	Maximum Predicted Noise Impact from SIL(E)					
	Revised Scenario			EIA Assessed Scenario		
	Max Noise Level	Exceedance and Duration		Max Noise Level	Exceedance and Duration	
<b><u>Airborne Noise Impact:</u></b>						
<b>Contract No. 903 (Ocean Park Station, Wong Chuk Hang Station, Viaduct and Aberdeen Channel Bridge)</b>						
HSS1	76	1-4dB(A) (4.8 months)	≥5dB(A) (3 months)	77	1-4dB(A) (1 month)	≥5dB(A) (8.5 months)
HSS2	75	1-4dB(A) (7.3 months)	≥5dB(A) (0.8 month)	76	1-4dB(A) (1 month)	≥5dB(A) (8.5 months)
HSS4	70	No exceedance		71	1-4dB(A) (1 month)	≥5dB(A) (-)
<b>Contract No. 907 (Wong Chuk Hang Depot Site Formation and Piling)</b>						
SIS1 <sup>[2]</sup>	71	1-4dB(A) (1 month)	≥5dB(A) (-)	71	1-4dB(A) (1 month)	≥5dB(A) (-)
SIS2 <sup>[1,2]</sup>	74	1-4dB(A) (5 months)	≥5dB(A) (-)	74	1-4dB(A) (5.5 month)	≥5dB(A) (-)
CPS <sup>[2]</sup>	75	1-4dB(A) (6 months)	≥5dB(A) (1 month)	76	1-4dB(A) (6.5 month)	≥5dB(A) (1 month)
<b>Contract No. 904 (Lei Tung Station)</b>						
YCB <sup>[3]</sup>	73	No exceedance		79	1-4dB(A) (11.5 months)	≥5dB(A) (-)
<b>Contract No. 904 (South Horizons Station and Tunnels)</b>						
SOH5	76	1-4dB(A) (8 months)	≥5dB(A) (-)	82	1-4dB(A) (0.5 month)	≥5dB(A) (2.5 months)
SOH6	79	1-4dB(A) (9.5 months)	≥5dB(A) (-)	81	1-4dB(A) (5.5 months)	≥5dB(A) (2.5 months)
SOH7	75	No exceedance		76	1-4dB(A) (2.5 months)	≥5dB(A) (-)
SOH8	77	1-4dB(A) (4.5 months)	≥5dB(A) (-)	78	1-4dB(A) (3 months)	≥5dB(A) (-)
PBPS <sup>[4]</sup>	66	No exceedance		68	1-4dB(A) (-)	≥5dB(A) (-)
<b><u>Ground-borne Noise Impact:</u></b>						
<b>Contract No. 904 (Lei Tung Station)</b>						
YOC4	72	7dB(A) (3 weeks)		73	8dB(A) (3 weeks)	

NSR	Maximum Predicted Noise Impact from SIL(E)			
	Revised Scenario		EIA Assessed Scenario	
	Max Noise Level	Exceedance and Duration	Max Noise Level	Exceedance and Duration
SPC	60	No exceedance	61	1dB(A) (8 weeks)

**Notes:**

- [1] SIS2 has been commenced for use since September 2011.
- [2] Cumulative impact from the construction of bus terminus and Contract No. 903 is considered minor and reference should be made to Sections 3.3 to 3.5 of the corresponding CNMMP given in *Annex B* for the cumulative noise impact.
- [3] YCB is blocked by a new hotel and a 5dB(A) attenuation is assumed.
- [4] The Max Noise Level indicated above has not taken into account the noise contribution on the EPIW and reference should be made to Section 3.8 of the corresponding CNMMP given in *Annex D* for the cumulative noise impact with EPIW. It can be concluded that the construction of the SOH Station would not contribute significant noise impacts at the PBPS.

Given that the construction plant inventory has been updated in this CNMMP for individual Contracts, the noise control measures recommended in Section 3.4.1.4 of the approved SIL(E) EIA Report are remain valid.

In conclusion, this CNMMP has been prepared involving the Contractors for the various Contracts and is considered realistic and reflects the pragmatic solutions to further reduce the predicted noise exceedance and durations described in the approved SIL (E) EIA report.

Annex A

CNMMP for Contract No.  
903 (Ocean Park Station,  
Wong Chuk Hang Station,  
Viaduct and Aberdeen  
Channel Bridge)

LEIGHTON  
禮頓



C903

## Noise Mitigation Measures Plan

**About this document, Revision History and Plan Approval**

This document is available for all project employees via the project network. We regularly revise this document and the latest version is always available electronically. Once printed, the document should no longer be considered to be the latest version. It may be distributed to the MTR Corporation Limited (MTR) and/or the Engineer's Representative on the understanding that any such document may not be the latest version or it may be distributed to the MTR and/or the Engineer's Representative as a controlled document in which case the front cover is to be stamped "Controlled Copy" in red and a copy number added.

The Quality and Environment Manager (QEM) is responsible for updating and maintaining the plan, including the original hard copy, which should be signed by the person in charge of the project to indicate approval.

The status of this plan is identified by a revision number and date on each page. Changes to the document are identified by a vertical single line in the right-hand margin. On revision, the plan will be uploaded as a whole to the project server or within the Leighton Asia Document Management System Technical Documents Module. The Quality and Environment Manager maintains a record of the revision status of the plan, which is available on request.

If you have any enquiry relating to this plan, please contact the Quality and Environment Manager.

**Revision History and Plan Approval**

Revision	Date	Prepared by	Checked by	Approved by	Section/Description
00	??	Helen Cochrane	??	??	Initial Issue

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## Appendices

- Appendix A Construction Schedule and Plant Inventory
- Appendix B Construction Air-borne Noise Assessment (Mitigation Scenario)

## 1. Introduction

- 1.1 In December 2007, the Government gave the approval for the MTR Corporation Limited (MTRCL) to proceed with preliminary planning and design of the South Island Line eastern section (SIL(E)(E)). The SIL(E)(E) (The Project) will be a medium capacity railway that measures a total length of approximately 7 km. It will run from Admiralty to South Horizons, with three intermediate stations at Ocean Park, Wong Chuk Hang and Lei Tung.
- 1.2 The construction of the South Island Line has been divided into a series of Contracts and Contract 903, covering the section of the South Island Line (East) from Nam Fung Portal to the Aberdeen Channel Bridge and including stations at Wong Chuk Hang and Ocean Park, was awarded to Leighton Contractors (Asia) Limited (LCAL) in April 2011.
- 1.3 The South Island Line (East) Environmental Impact Assessment (SIL(E) EIA) Report for the Project was submitted and subsequently approved with conditions by the Environmental Protection Department (EPD) on 26 Oct 2010.
- 1.4 Condition 2.9 of the approved Environmental Permit (EP-407/2010) stated that: "To further reduce the construction noise impacts on the 12 noise sensitive receivers (NSRs) with predicted exceedance in air-borne construction noise and the 2 NSRs with predicted exceedance in ground-borne construction noise in the approved EIA Report, the Permit Holder shall, at least one month before commencement of construction of the project, submit to the Director for approval four hard copies and one electronic copy of a construction noise mitigation measures plan"
- 1.5 Meinhardt Infrastructure and Environment Ltd. (MIEL) has been commissioned by Leighton Contractors (Asia) Limited (LCAL) to assist in the preparation of the above mentioned Noise Mitigation Measures Plan (NMMP) for SIL(E) Contract 903 (C903).
- 1.6 Of the 12 NSRs covered by the SIL(E) EIA and required to be included in the NMMP by the EP, only 3 of them are relevant to C903, namely 3 facades of the Holy Spirit Seminary. The Holy Spirit Seminary is located at the end of Welfare Road and is within about 30m of SIL C903 Viaduct D connecting the Wong Chuk Hang Station to the new Aberdeen Channel Bridge. The EIA predicted that this NSR, assigned as HSS1, HSS2 and HSS4, would suffer from construction airborne noise impacts up to a maximum of 77dB(A). As this NSR is classified as an institutional NSR, the construction noise criteria is 70dB(A) for normal school days. Thus, the residual impacts are therefore up to 7dB(A). The locations of the NSRs and SIL(E) alignment under C903 are shown in **Figure 1.1**.
- 1.7 This NMMP is prepared to comply with Condition 2.9 of the SIL(E) EP and presents the following information as required by the EP:
- a schedule of construction works to be carried out at the works areas of the Project within 300m from the NSRs HSS1, HSS2 and HSS4;
  - an updated construction methodology of the proposed construction works;

- an updated powered mechanical equipment (PME) list for the proposed construction works;
- an updated proposal of air-borne noise mitigation measures for the 3 NSRs as shown in **Figure 1.1** including the provision of noise barriers, enclosures and Indirect Technical Remedies; and
- an updated prediction of noise levels in accordance with the above updated information and mitigation proposals in place.

## 2. Description of the Construction Works in the Study Area

2.1 The 300m study areas of HSS1, HSS2 and HSS4 are shown in **Figure 1.1**. The main construction works proposed to be carried out in these areas will comprise the construction of Viaduct D, together with the Aberdeen Channel Bridge. Both involving construction of the viaduct piers and erection of the viaduct decking and associated noise barriers. Site clearance, including tree felling, slope stabilization and other enabling works will, also, be undertaken for the land works.

### Construction Methodology

2.2 The proposed construction methodology is generally similar to that assumed in the SIL(E) EIA assessed scenario. The piers are proposed to be constructed by piling for the foundations, followed by in-situ casting and the viaduct segments will be raised by beam and winch system. The beam and winch system is comparable to a conventional crane lifting system and is considered the best methodology to be adopted.

2.3 Site preparation in terms of tree felling and slope improvement is also required since a portion of the Viaduct D alignment transects the vegetated slope below the Holy Spirit Seminary.

2.4 At the western end of C903, Viaduct D connects to the future Aberdeen Channel Bridge (ACB) and while works associated with the pier construction will be undertaken from the Aberdeen Channel, in order to facilitate access to the first pier E1 on the eastern side of the bridge, a haul road is also proposed.

2.5 A breakdown of the major construction activities in sequence to be carried out along the viaduct and ACB sections within 300m of the NSRs are shown below and detailed in **Appendix A**.

### Viaduct D (WCH to ACB) – Piers D4 to D18/E1

- Activity 1 – Tree felling, hoarding / fence erection, access formation, etc. (Preparation works from D5 to D11 )
- Activity 2 – Bored piling at D5 to D11;
- Activity 3 – Pilecap construction at D5 to D11;
- Activity 4 – Pier construction for D5 to D11;
- Activity 5 – Slope improvement (from D5 to D8);
- Activity 6 – Tree felling, hoarding / fence erection, access formation, etc. (Preparation works from D12 to D18/E1);
- Activity 7 – Slope improvement (from D12 to D18/E1);
- Activity 8 – Pad footing construction (from D12 to D18/E1);

- Activity 9 – Pier construction for D12 to D17;
- Activity 10 – Segment erection (from D18/E1 to D5);
- Activity 11 – Cast In-situ Decking (from D18/E1 to D13); and
- Activity 12 – Noise barrier erection (from D18/E1 to D5).

#### **Aberdeen Channel Bridge – Piers E2 to E3**

- Activity 1 – Formation of access road for E2;
- Activity 2 – Drainage Diversion beside E2;
- Activity 3 – Pipe Piling and trestle erection for E2;
- Activity 4 – Bored piling for E2;
- Activity 5 – Pilecap construction at E2;
- Activity 6 – Pier construction for E2;
- Activity 7 – Cast in-situ segment E2-1N & E2-1S;
- Activity 8 – Bridge deck construction;
- Activity 9 – Utilities Diversion at E3;
- Activity 10 – Sea wall modification and pipe piling for E3;
- Activity 11 – Bored piling for E3;
- Activity 12 – Pilecap construction at E3;
- Activity 13 – Reinstatement of seawall;
- Activity 14 – Pier construction for E3;
- Activity 15 – Cast in-situ segment E3-1N & E3-1S;
- Activity 16 – Bridge deck construction; and
- Activity 17 – Noise barrier erection (from E2 to E3);

2.6 Construction noise impacts are generally generated by the construction of piers, where piling, excavation and rock breaking are involved. Also, during segment erection, since the PMEs are elevated and become closer to the NSRs, this activity, also, has the potential to generate significant construction noise impacts.

#### **Revised Construction Schedule**

2.7 The detailed construction scheduling prepared by LCAL has been used in this NMMP and

has been presented on a week by week basis for the duration of the construction works in the Study Area. The construction schedule has been adjusted such that construction works are not carried out concurrently at the same location as far as possible. The revised construction schedule is provided in **Appendix A**.

### **Updated Powered Mechanical Equipment List**

2.8 The updated Powered Mechanical Equipment (PME) list for the construction works is provided in **Table 2.1** below. The Sound Power Levels (SWL) for the PMEs have been adopted from BS 5228–1:2009 or EPD's Technical Memorandum on Noise from Construction Work other than Percussive Piling. It should be noted that the selected PME for assessment can be found in Hong Kong market. The PME as relevant to individual construction activities are provided in **Appendix A**.

**Table 2.1 Updated PME List for the Construction Works**

PME	TM or BS Reference	Sound Power Level, dB(A)
Vibrating plate / tamping rammer	BS5228 Table D.3/119	105
Excavator (45kW)	BS5228 Table D.3/35	106
Excavator mounted hydraulic vibratory hammer w/ power pack	BS5228 Table D.3/35	106
Hydraulic casing oscillator with power pack	BS5228 Table D.4/47	115
Hydraulic oscillator w/ power pack (for extracting casing)	BS5228 Table D.4/47	115
Scissors Lift	BS5228 Table C.4/57	95
Grouting machine (with pump)	BS5228 Table D.5/13	108
Shotcreting machine	BS5228 Table D.5/13	108
Grouting machine (with pump & mixer)	BS5228 Table D.5/13	108
Concrete mixer truck	BS5228 Table D.6/35	100
Vibratory poker (petrol type)	BS5228 Table D.6/40	98
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	101
Mobile / crawler crane	BS5228 Table D.7/114	101
16Ton mobile crane	BS5228 Table D.7/114	101
80Ton mobile crane	BS5228 Table D.7/114	101
Crawler crane (120 Ton, using grab or lifting only)	BS5228 Table D.7/119	109
Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	109
crawler crane (120Ton)	BS5228 Table D.7/119	109
crawler crane (200 Ton)	BS5228 Table D.7/119	109
Hand-held electric saw	BS5228 Table D.7/76	106
Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	110
Excavator (15 Ton)	BS5228 Table D.8/33	102
Dump truck (24 Ton)	BS5228 Table D.9/39	103

PME	TM or BS Reference	Sound Power Level, dB(A)
Trailer	BS5228 Table D.9/39	103
Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	114
Drilling rig (for pre-boring when encountering rock)	BS5228 Table D.10/3	114
Pneumatic soil nail drill	BS5228 Table D.10/3	114
Pneumatic Drilling rig	BS5228 Table D.10/3	114
Air compressor (flow >10m <sup>3</sup> /min & ≤ 30m <sup>3</sup> /min.)	CNP 002	102
Air compressor (flow >10m <sup>3</sup> /min, < 30m <sup>3</sup> /min.) x 1	CNP 002	102
Hand-held pneumatic breaker	CNP 025	111
Concrete pump (stationary / truck mounted)	CNP 047	109
Tower crane	CNP 049	95
Form traveller (with power pack)	CNP 049	95
Flat top barge (30m long)	CNP 061	104
Hand-held electric drill	CNP 064	103
Electric drill	CNP 064	103
Dump truck with grab	CNP 069	105
Generator (150kVA)	CNP 102	100
Flat deck lorry	CNP 143	101
Vibratory roller	CNP 186	108
Hydraulic prestressing jack (with power Pack)	CNP 261	110
Beam & Winch Set (with 200 KVA genset)	CNP 262	95
Water pump (electric)	CNP 281	88

### 3. Noise Assessment and Proposed Mitigation Measures

#### Assessment Methodology and Assumptions

- 3.1 The construction noise assessment has been carried out in accordance to the methodology used in the approved SIL(E) EIA. Notional source distances have been measured at the mid-point of the viaduct piers.
- 3.2 The percentage on-time for each PME has been estimated individually for each construction activity to ensure practicality and is consistent with the assumptions used in the SIL(E) EIA.
- 3.3 All proposed mitigation measures in this NMMP and their effectiveness have been previously adopted in the SIL(E) EIA and silent plant, noise barriers, including movable barriers and enclosure/sheds, and acoustic fabric have been considered, as detailed in **Table 3.1** below. Detailed implementation plan will be shown in **Appendix A**.

**Table 3.1 Mitigation Measures Adopted for the PMEs within the Study Area**

PME	Type of Noise Barrier	Noise Level Reduction, dB(A)
Air compressor (flow >10m <sup>3</sup> /min & ≤= 30m <sup>3</sup> /min.)	Enclosure / Shed	-15
Concrete pump (stationary / truck mounted)	Enclosure / Shed	-15
Generator (150kVA)	Movable Barrier	-10
Drilling rig (for pre-boring when encountering rock)	Fabric	-10
Hand-held pneumatic breaker	Movable Barrier	-10
Hydraulic casing oscillator with power pack	Fabric	-10
Hydraulic oscillator w/ power pack (for extracting casing)	Fabric	-10
Hydraulic prestressing jack (with power pack)	Movable Barrier	-10
Pneumatic drilling rig	Fabric	-10
Pneumatic soil nail drill	Fabric	-10
Reversed Circular Drill (RCD, with power pack)	Fabric	-10
Vibratory poker (petrol type)	Movable Barrier	-10
Water pump (electric)	Movable Barrier	-10
16Ton mobile crane	Movable Barrier	-5
80Ton mobile crane	Movable Barrier	-5
Crane lorry (17 Ton jib)	Movable Barrier	-5
Crawler crane (120 Ton, lifting only)	Movable Barrier	-5
Crawler crane (120 Ton, using grab or lifting only)	Movable Barrier	-5

PME	Type of Noise Barrier	Noise Level Reduction, dB(A)
crawler crane (120Ton)	Movable Barrier	-5
crawler crane (200 Ton)	Movable Barrier	-5
Excavator (15 Ton)	Movable Barrier	-5
Excavator (45kW)	Movable Barrier	-5
Hydraulic breaker, excavator mounted, 52kW	Movable Barrier	-5
Mobile / crawler crane	Movable Barrier	-5

- 3.4 For each major construction activities, different groups of PMEs for specific purpose will be required. Since different groups of PMEs cannot operate at the same time in the same location, the groups of PMEs with the highest SWL have been used to calculate the noise level of the construction activity to present the worst case scenario.

#### Proposed Mitigation Strategy and Noise Assessment Results

- 3.5 The cumulative impacts for all construction activities have been assessed, and the calculated assessment results are presented in **Appendix B** and summarised in **Table 3.2** below. The proposed mitigation measures described above are included in the assessment and, as such, the mitigated scenario only has been presented.
- 3.6 As shown in **Table 3.2** below, by the implementation of quiet plant, noise barriers, enclosures/sheds and acoustic fabric for the PMEs and rescheduling the construction works as far as possible to avoid cumulative impacts, the maximum construction noise impact at HSS1 and HSS2 can be reduced by about 1dB(A) compared to the predicted values in the SIL(E) EIA report, and also the durations of the exceedances at the NSRs have been shortened. In addition, the maximum construction noise impacts at HSS4 have been reduced to 70dB(A) and therefore, based upon the revised construction works and scheduling, no exceedances are predicted.

**Table 3.2 Updated Mitigated Construction Noise Impact at Respective NSRs**

NSR	Maximum Noise Impact from SIL(E)					
	Revised Scenario			EIA Assessed Scenario		
	Max Noise Level	Exceedance and Duration		Max Noise Level	Exceedance and Duration	
HSS1	76	1-4dB(A) (4.8 months)	≥5dB(A) (3 months)	77	1-4dB(A) (1 month)	≥5dB(A) (8.5 months)
HSS2	75	1-4dB(A) (7.3 months)	≥5dB(A) (0.8 month)	76	1-4dB(A) (1 month)	≥5dB(A) (8.5 months)
HSS4	70	1-4dB(A) (--)	≥5dB(A) (--)	71	1-4dB(A) (1 month)	≥5dB(A) (--)

- 3.7 After the implementation of all above mentioned mitigation measures, the NSRs will now be exposed to a maximum construction noise impact of 76dB(A) and 75dB(A) at HSS1 and HSS2 respectively which present reductions on the predications presented in the EIA. Also,

the duration of which the NSRs experience exceedances are reduced to about 8 months from 9.5 months. In addition, there would be no residual impacts predicted at HSS4.

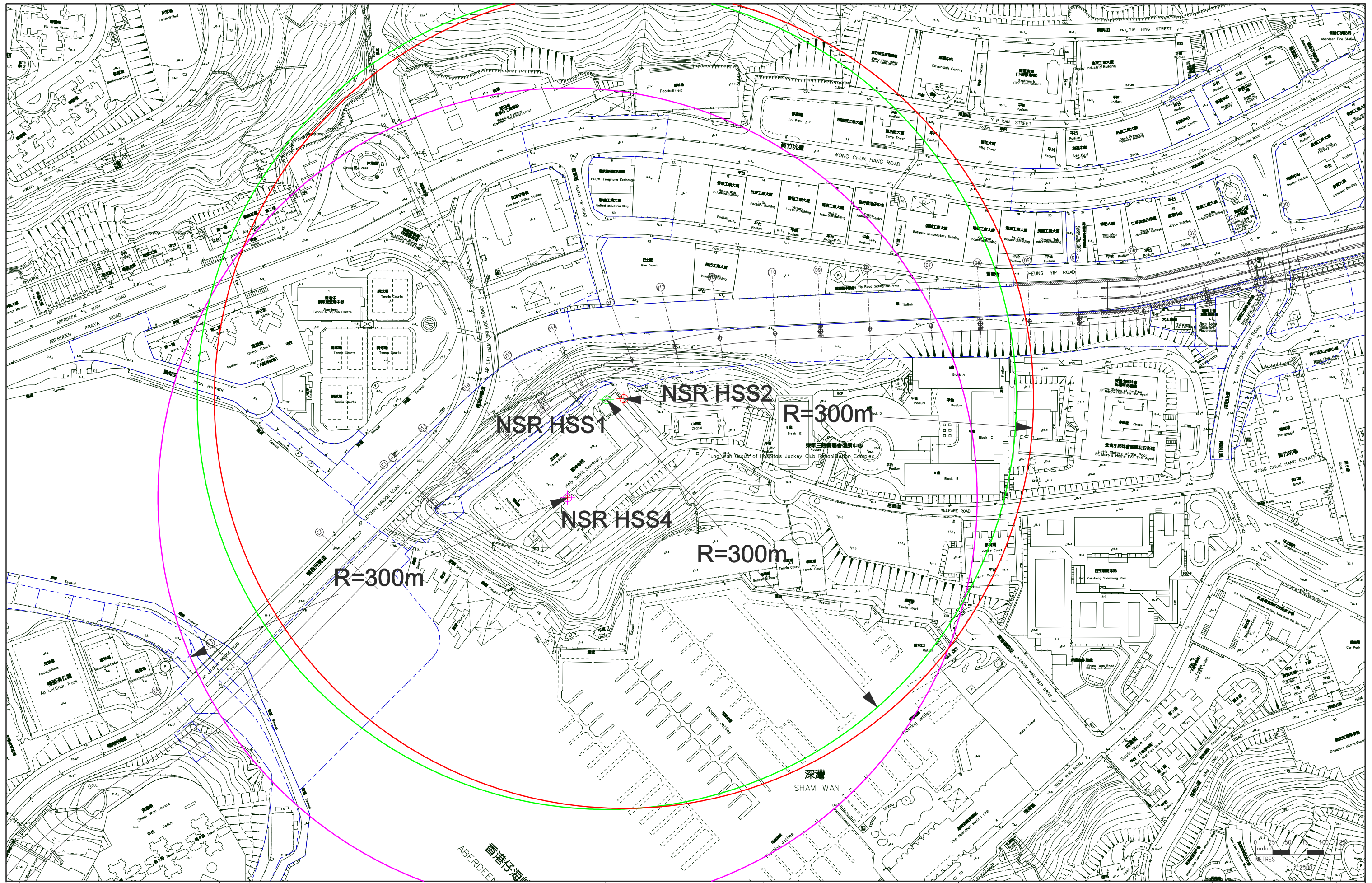
### **Indirect Technical Remedies**

- 3.9 It should be noted that the use of Indirect Technical Remedies (ITR) as a mitigation measure is neither a requirement stipulated under Annex 13 of the EIAO-TM nor the EIA Study Brief. The provision of ITR is the initiative of the Project Proponent in view of the noise disturbance associated with the construction of the SIL(E). Consideration will be given to make reference to the previous approved EIA of WIL for the eligibility criteria proposed for qualifying NSRs for ITR which would be dependent on the severity of the residual noise impact and duration of exceedance after implementing all practical direct mitigation measures. Correspondences between MTRC and Holy Spirit Seminary indicated that approximately 30 to 40 areas/rooms among 5 no. of floors in Holy Spirit Seminary (HSS1 and HSS2) have been identified as eligible for the proposed ITR where double glazed windows are to be provided.

#### 4. Conclusion

- 4.1 With the implementation of the proposed noise mitigation measures, construction noise impacts are now predicted to be reduced in respect of both exceedances and duration.
- 4.2 Further review and update will be performed during the construction phase and liaison with affected parties is essential to minimise the construction noise impacts as far as possible.

## FIGURES



PRINTED BY: \$USER\$ \$DATE\$ \$TIME\$  
 MODELNAME: \$MODEL\$ \$FILE\$ \$DATE\$ \$TIME\$  
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REV	DESCRIPTION	DATE

DESIGNED BY: \_\_\_\_\_  
 DRAWN BY: \_\_\_\_\_  
 CHECKED BY: \_\_\_\_\_  
 IN CHARGE: \_\_\_\_\_  
 DATE: \_\_\_\_\_

MAIN CONTRACTOR:



CONSULTANT:



Meinhardt Infrastructure and Environment Limited  
 邁道基建築環保工程顧問有限公司

CLIENT:



PROJECT: South Island Line (East) Contract 903  
 Ocean Park Station, Wong Chuk Hang Station,  
 Viaducts and Aberdeen Channel Bridge

DRAWING TITLE: LAYOUT PLAN FOR NSR

DRAWING NUMBER: FIGURE 1.1

CAD REF: \_\_\_\_\_ SCALE: 1:2500 @ A3

STATUS: \_\_\_\_\_

## APPENDICES

## Appendix A



Appendix A  
Construction Schedule and Plant Inventory

Construction Schedule

Mitigated Plant Inventory

Activity 3 - Pilecap construction at D5 to D11

Group D3.1 - Sheet Piling									
Excavator mounted hydraulic vibratory hammer w/ power pack	BS5228 Table D.3/35	1	106					80%	105
Drilling rig (for pre-boring when encountering rock)	BS5228 Table D.10/3	1	114	-10		Fabric		20%	97
crawler crane (120Ton)	BS5228 Table D.7/119	1	109	-5		Movable Barrier		20%	97
Welding set (electric)	Not a PME	2	0					20%	0
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5		Movable Barrier		20%	89
Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5		Movable Barrier		20%	90
<b>Total</b>									106
Group D3.2 - Excavation & shoring									
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5		Movable Barrier		80%	100
crawler crane (120Ton)	BS5228 Table D.7/119	1	109					20%	102
Welding set (electric)	Not a PME	2	0					20%	0
Water pump (electric)	CNP 281	2	88					40%	87
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101					20%	94
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103					40%	99
<b>Total</b>									106
Group D3.3 - Pilehead treatment									
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5		Movable Barrier		70%	99
Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5		Movable Barrier		60%	103
Hand-held pneumatic breaker	CNP 025	2	111	-10		Movable Barrier		40%	100
Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15		Enclosure / Shed		100%	87
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103					20%	96
Water pump (electric)	CNP 281	2	88					100%	91
<b>Total</b>									106
Group D3.4 - Rebar & Formwork									
Crawler crane (120Ton)	BS5228 Table D.7/119	1	109	-5		Movable Barrier		40%	100
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101					20%	94
Water pump (electric)	CNP 281	2	88					100%	91
Hand-held electric saw	BS5228 Table D.7/76	2	106					20%	102
Hand-held electric drill	CNP 064	2	103					20%	99
<b>Total</b>									106
Group D3.5 - Concreting using pump									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15		Enclosure / Shed		80%	93
Concrete mixer truck	BS5228 Table D.6/35	2	100					80%	102
Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98					70%	101
<b>Total</b>									105
Group D3.6 - Backfilling incl. removal of shoring									
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5		Movable Barrier		70%	99
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103					40%	99
Vibratory roller	CNP 186	1	108					20%	101
Vibrating plate / tamping rammer	BS5228 Table D.3/119	1	105					20%	98
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101					20%	94
Water pump (electric)	CNP 281	2	88					70%	89
<b>Total</b>									106
Group D3.7 - Extracting Sheet Piles									
Excavator mounted hydraulic vibratory hammer w/ power pack	BS5228 Table D.3/35	1	106	-5		Movable Barrier		80%	100
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101					20%	94
Excavator (15 Ton)	BS5228 Table D.8/33	1	102					20%	95
Vibratory roller	CNP 186	1	108					20%	101
<b>Total</b>									105

Appendix A  
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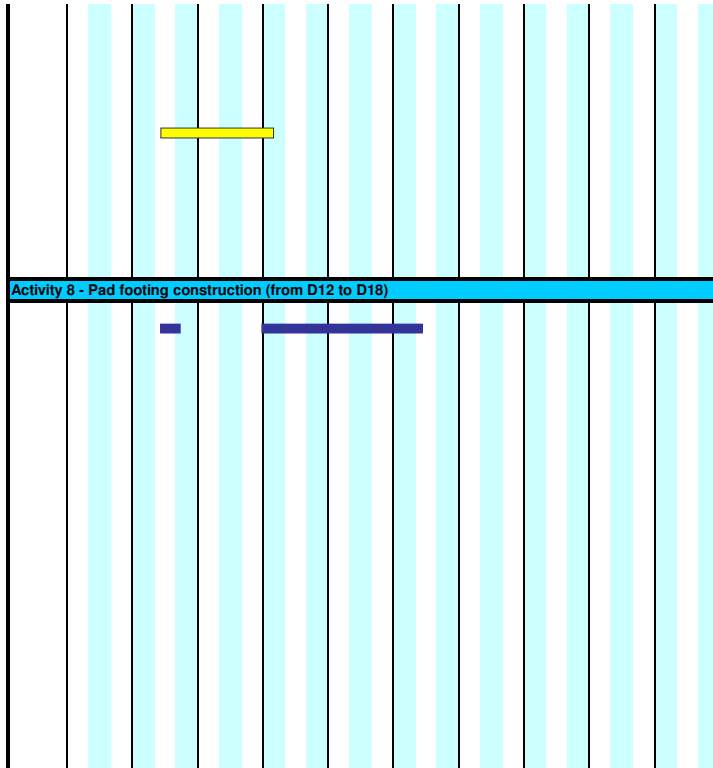
Construction Schedule

Mitigated Plant Inventory

Activity 4 - Pier construction for D5 to D11																					
											<b>Group D4.1 - Rebar &amp; Formwork</b>										
											Crawler crane (120Ton)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	60%	102			
											Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94			
											Hand-held electric drill	CNP 064	2	103			20%	99			
											Water jet	CNP 281	1	88			20%	81			
																	<b>Total</b>	104			
											<b>Group D4.2 - Concreting using pump</b>										
											Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93			
											Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102			
											Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98	-10	Movable Barrier	70%	89			
																	<b>Total</b>	103			
Activity 5 - Slope improvement (from D5 to D6)																					
											<b>Group D5.1 - Soil nailing</b>										
											Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			20%	102			
											Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94			
											Pneumatic soil nail drill	BS5228 Table D.10/3	2	114	-10	Fabric	70%	105			
											Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	2	102	-15	Enclosure / Shed	100%	90			
											Grouting machine (with pump)	BS5228 Table D.5/13	1	108			20%	101			
											Shotcreting machine	BS5228 Table D.5/13	1	108			20%	101			
																	<b>Total</b>	109			
											<b>Group D5.2 - Rock scaling</b>										
											Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	75%	103			
											Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102			100%	102			
											Dump truck with grab	CNP 069	1	105			20%	98			
																	<b>Total</b>	106			
											<b>Group D5.3 - Structures excl. concreting</b>										
											Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			30%	104			
											Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94			
											Hand-held electric saw	BS5228 Table D.7/76	2	106			20%	102			
											Hand-held electric drill	CNP 064	2	103			20%	99			
																	<b>Total</b>	107			
											<b>Group D5.4 - Concreting using pump</b>										
											Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93			
											Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102			
											Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98			70%	99			
																	<b>Total</b>	104			
Activity 6 - Tree felling, hoarding / fence erection, access formation, etc. (Preparation works from D12 to D18)																					
											<b>Group D6.1 - Forming access road</b>										
											Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	80%	100			
											Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Barrier	25%	99			
											Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	20%	97			
											Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87			
											Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			40%	99			
											Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5	Movable Barrier	20%	89			
																	<b>Total</b>	105			
											<b>Group D6.2 - Tree felling &amp; clearance</b>										
											Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	70%	99			
											Mobile / crawler crane	BS5228 Table D.7/114	1	101			70%	99			
											Dump truck with grab	CNP 069	1	105			40%	101			
																	<b>Total</b>	105			
											<b>Group D6.3 - Hoarding / Fence erection</b>										
											Excavator (45kW)	BS5228 Table D.3/35	1	106			30%	101			
											Welding set (electric)	Not a PME	2	0			50%	0			
											Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94			
											Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96			
																	<b>Total</b>	103			
Activity 7 - Slope improvement (from D12 to D18)																					
											<b>Group D7.1 - Mass concrete retaining wall excl. concreting (D13 / D14)</b>										
											Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			30%	104			
											Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94			
											Hand-held electric saw	BS5228 Table D.7/76	2	106			20%	102			
											Hand-held electric drill	CNP 064	2	103			20%	99			
																	<b>Total</b>	107			

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Construction Schedule



Mitigated Plant Inventory

Group D7.2 - Concreting using pump									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98			70%	99		
							<b>Total</b>	104	
Group D7.3 - Soldier pile wall at D17									
Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97		
Pneumatic drilling rig	BS5228 Table D.10/3	1	114	-10	Fabric	80%	103		
Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87		
Welding set (electric)	Not a PME	2	0			20%	0		
Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95		
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96		
Grouting machine (with pump & mixer)	BS5228 Table D.5/13	1	108			20%	101		
							<b>Total</b>	107	
Activity 8 - Pad footing construction (from D12 to D18)									
Group D8.1 - Excavation									
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	80%	100		
Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Barrier	50%	102		
Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	20%	97		
Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87		
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			30%	98		
							<b>Total</b>	106	
Group D8.2 - Rebar & formwork									
Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			20%	102		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			30%	96		
Hand-held electric saw	BS5228 Table D.7/76	2	106			20%	102		
Hand-held electric drill	CNP 064	2	103			30%	101		
							<b>Total</b>	107	
Group D8.3 - Concreting using pump									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98			70%	99		
							<b>Total</b>	104	
Group D8.4 - Backfilling									
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	70%	99		
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			40%	99		
Vibratory roller	CNP 186	1	108			20%	101		
Vibrating plate / tamping rammer	BS5228 Table D.3/119	1	105			20%	98		
							<b>Total</b>	106	





Appendix A  
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Construction Schedule

Mitigated Plant Inventory

Activity 5 - Pilecap construction at E2

Activity 5 - Pilecap construction at E2									
<b>Group A5.1 - Pilehead treatment</b>									
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	70%	99		
Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Barrier	60%	103		
Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	40%	100		
Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87		
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96		
Water pump (electric)	CNP 281	2	88			100%	91		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	107	
<b>Group A5.2 - Rebar &amp; Formwork</b>									
Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94		
Water pump (electric)	CNP 281	2	88			100%	91		
Hand-held electric drill	CNP 064	2	103			20%	99		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	107	
<b>Group A5.3 - Concreting using pump</b>									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	105	

Activity 6 - Pier construction for E2

Activity 6 - Pier construction for E2									
<b>Group A6.1 - Rebar &amp; Formwork</b>									
Tower crane	CNP 049	1	95			60%	93		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94		
Hand-held electric drill	CNP 064	2	103			20%	99		
Water jet	CNP 281	1	88			20%	81		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	102	
<b>Group A6.2 - Concreting using pump</b>									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Tower crane	CNP 049	1	95			20%	88		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98	-10	Movable Barrier	70%	89		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	103	

Activity 7 - Cast in-situ segment E2-1N & E2-1S

Activity 7 - Cast in-situ segment E2-1N & E2-1S									
<b>Group A7.1 - Rebar &amp; Formwork</b>									
Tower crane	CNP 049	1	95			60%	93		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94		
Hand-held electric drill	CNP 064	2	103			20%	99		
Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87		
Water jet	CNP 281	1	88			20%	81		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	102	
<b>Group A7.2 - Concreting using pump</b>									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Tower crane	CNP 049	1	95			20%	88		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98	-10	Movable Barrier	70%	89		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	103	



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Activity 11 - Bored piling for E3

Activity 11 - Bored piling for E3																																																																																																																																																																																																																																																																																																																																				
<b>Group A11.1 - Excavation to rockhead</b>																																																																																																																																																																																																																																																																																																																																				
													Crawler crane (120 Ton, using grab or lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	90%	104						Hydraulic casing oscillator with power pack	BS5228 Table D.4/47	1	115	-10	Fabric	30%	100						Welding set (electric)	Not a PME	1	0			20%	0						Water pump (electric)	CNP 281	2	88			50%	88						Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5	Movable Barrier	20%	90						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104				
Crawler crane (120 Ton, using grab or lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	90%	104						Hydraulic casing oscillator with power pack	BS5228 Table D.4/47	1	115	-10	Fabric	30%	100						Welding set (electric)	Not a PME	1	0			20%	0						Water pump (electric)	CNP 281	2	88			50%	88						Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5	Movable Barrier	20%	90						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																	
Hydraulic casing oscillator with power pack	BS5228 Table D.4/47	1	115	-10	Fabric	30%	100						Welding set (electric)	Not a PME	1	0			20%	0						Water pump (electric)	CNP 281	2	88			50%	88						Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5	Movable Barrier	20%	90						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																														
Welding set (electric)	Not a PME	1	0			20%	0						Water pump (electric)	CNP 281	2	88			50%	88						Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5	Movable Barrier	20%	90						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																											
Water pump (electric)	CNP 281	2	88			50%	88						Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5	Movable Barrier	20%	90						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																								
Excavator (15 Ton)	BS5228 Table D.8/33	1	102	-5	Movable Barrier	20%	90						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																					
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.2 - Rock drilling to founding level</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																		
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Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																						
Reversed Circular Drill (RCD, with power pack)	BS5228 Table D.10/3	1	114	-10	Fabric	90%	104						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																			
Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																
Water pump (electric)	CNP 281	2	88			100%	91						Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																													
Excavator (15 Ton)	BS5228 Table D.8/33	1	102			20%	95						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																										
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																							
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	106					<b>Group A11.3 - Concreting using crane</b>													Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																																				
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<b>Group A11.3 - Concreting using crane</b>																																																																																																																																																																																																																																																																																																																																				
Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	30%	99						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																																																																											
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																																																																																								
Air compressor (flow >10m3/min, < 30m3/min.) x 1	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																																																																																																					
Water pump (electric)	CNP 281	2	88			40%	87						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																																																																																																																		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	104																																																																																																																																																																																																																																																																																																															
							<b>Total</b>	104																																																																																																																																																																																																																																																																																																																												

Activity 12 - Pilecap construction at E3

Activity 12 - Pilecap construction at E3																																																																																																																																																																																																																																																																																													
<b>Group A12.1 - Pilehead treatment</b>																																																																																																																																																																																																																																																																																													
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	70%	99						Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Barrier	60%	103						Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	40%	100						Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105				
Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Barrier	60%	103						Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	40%	100						Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																	
Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Barrier	40%	100						Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																														
Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																											
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																								
Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																					
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.2 - Rebar &amp; Formwork</b>													Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																		
							<b>Total</b>	107																																																																																																																																																																																																																																																																																					
<b>Group A12.2 - Rebar &amp; Formwork</b>																																																																																																																																																																																																																																																																																													
Crawler crane (120Ton)	BS5228 Table D.7/119	1	109			40%	105						Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																									
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94						Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																						
Water pump (electric)	CNP 281	2	88			100%	91						Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																			
Hand-held electric drill	CNP 064	2	103			20%	99						Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																
Water pump (electric)	CNP 281	2	88			100%	91						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																													
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	107					<b>Group A12.3 - Concreting using pump</b>													Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																																										
							<b>Total</b>	107																																																																																																																																																																																																																																																																																					
<b>Group A12.3 - Concreting using pump</b>																																																																																																																																																																																																																																																																																													
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93						Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																																																																																	
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102						Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																																																																																														
Vibratory poker (petrol type)	BS5228 Table D.6/40	3	98			70%	101						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																																																																																																											
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	105																																																																																																																																																																																																																																																																								
							<b>Total</b>	105																																																																																																																																																																																																																																																																																					

Activity 13 - Reinstatement

Activity 13 - Reinstatement																																																																
<b>Group A13</b>																																																																
Crawler crane (120 Ton, lifting only)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	20%	97						Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	60%	99						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	103				
Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Barrier	60%	99						Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	103																	
Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			20%	96						Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	103																														
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93													<b>Total</b>	103																																											
							<b>Total</b>	103																																																								

Appendix A  
Construction Schedule and Plant Inventory

Construction Schedule

Mitigated Plant Inventory

Activity 14 - Pier construction for E3

Group A14.1 - Rebar & Formwork									
Crawler crane (120Ton)	BS5228 Table D.7/119	1	109	-5	Movable Barrier	60%	102		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5	Movable Barrier	20%	89		
Hand-held electric drill	CNP 064	2	103			20%	99		
Water jet	CNP 281	1	88			20%	81		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	104	
Group A14.2 - Concreting using pump									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98	-10	Movable Barrier	70%	89		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	103	

Activity 15 - Cast in-situ segment E3-1N & E3-1S

Group A15.1 - Rebar & Formwork									
Tower crane	CNP 049	1	95			50%	92		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5	Movable Barrier	20%	89		
Hand-held electric drill	CNP 064	2	103			20%	99		
Water jet	CNP 281	1	88			20%	81		
Generator (150kVA)	CNP 102	1	100	-10	Enclosure / Shed	100%	90		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	101	
Group A15.2 - Concreting using pump									
Concrete pump (stationary / truck mounted)	CNP 047	1	109	-15	Enclosure / Shed	80%	93		
Tower crane	CNP 049	1	95			20%	88		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98	-10	Movable Barrier	70%	89		
Generator (150kVA)	CNP 102	1	100	-10	Enclosure / Shed	100%	90		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	104	

Activity 16 - Bridge deck construction

Group A16.1									
Form traveller (with power pack)	CNP 049	1	95			70%	93		
Tower crane	CNP 049	1	95			60%	93		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101			20%	94		
Hand-held electric drill	CNP 064	2	103			20%	99		
Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure / Shed	100%	87		
Water jet	CNP 281	1	88			20%	81		
Hydraulic prestressing jack (with power pack)	CNP 261	2	110	-10	Movable Barrier	30%	98		
Generator (150kVA)	CNP 102	1	100	-10	Enclosure / Shed	100%	90		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	104	
Group A16.2 - Concreting using tower crane									
Tower crane	CNP 049	1	95			80%	94		
Concrete mixer truck	BS5228 Table D.6/35	2	100			80%	102		
Vibratory poker (petrol type)	BS5228 Table D.6/40	2	98			70%	99		
Generator (150kVA)	CNP 102	1	100	-10	Enclosure / Shed	100%	90		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	105	
Group A16.3 - Prestressing & grouting									
Tower crane	CNP 049	1	95			20%	88		
Hydraulic prestressing jack (with power pack)	CNP 261	2	110	-10	Movable Barrier	70%	101		
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5	Movable Barrier	20%	89		
Grouting machine (with pump & mixer)	BS5228 Table D.5/13	1	108			20%	101		
Generator (150kVA)	CNP 102	1	100	-10	Enclosure / Shed	100%	90		
Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93		
							<b>Total</b>	105	

Appendix A  
Construction Schedule and Plant Inventory

Construction Schedule

Mitigated Plant Inventory

Activity 17 - Noise barrier erection (from E2 to E3)																					
											<b>Group A17</b>										
											16Ton mobile crane	BS5228 Table D.7/114	1	101	-5	Movable Barrier	70%	94			
											80Ton mobile crane	BS5228 Table D.7/114	1	101	-5	Movable Barrier	70%	94			
											Flat deck lorry	CNP 143	1	101			20%	94			
											Scissor lift / boom lift	BS5228 Table C.4/57	1	95			30%	90			
											Electric drill	CNP 064	1	103			20%	96			
											Generator, silenced, 75 dB(A) at 7 m	CNP 102	2	100	-10	Enclosure / Shed	100%	93			
																	<b>Total</b>	102			

## Appendix B

Appendix B  
Construction Airborne Noise Assessment (Mitigated Scenario)

NSR HSS1			2011												2012										
Work Site	Activity	SWL at Each Pier	Distance from NSR	Remarks	Attenuated SPL at NSR	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Wastock D (WCH to ACB) - Piers D4 to D18E1																									
D5	Activity 2 - Bored piling at D5 to D11	103	316	Out of 300m	0														0	0					
D5	Activity 3 - Pilecap construction at D5 to D11	104	316	Out of 300m	0															0	0				
D5	Activity 4 - Pier construction for D5 to D11	104	316	Out of 300m	0															0	0				
D5	Activity 2 - Bored piling at D5 to D11	105	281		51													51	51	51					
D5	Activity 3 - Pilecap construction at D5 to D11	105	281		52													52	52	52	52	52			
D5	Activity 4 - Pier construction for D5 to D11	104	281		50															50	50	50			
D7	Activity 2 - Bored piling at D5 to D11	105	245		53												53	53	53						
D7	Activity 3 - Pilecap construction at D5 to D11	105	245		54															54					
D7	Activity 4 - Pier construction for D5 to D11	104	245		51															51	51				
D8	Activity 2 - Bored piling at D5 to D11	105	202		54												54	54							
D8	Activity 3 - Pilecap construction at D5 to D11	105	202		55															55	55				
D8	Activity 4 - Pier construction for D5 to D11	104	202		53															53	53				
D9	Activity 2 - Bored piling at D5 to D11	105	167		56																				
D9	Activity 3 - Pilecap construction at D5 to D11	105	167		57																				
D9	Activity 4 - Pier construction for D5 to D11	104	167		50																				
D10	Activity 2 - Bored piling at D5 to D11	105	136		58																				
D10	Activity 3 - Pilecap construction at D5 to D11	105	136		59																				
D10	Activity 4 - Pier construction for D5 to D11	104	136		56																				
D11	Activity 2 - Bored piling at D5 to D11	105	99		60																				
D11	Activity 3 - Pilecap construction at D5 to D11	105	99		62																				
D11	Activity 4 - Pier construction for D5 to D11	104	99		59																				
D12	Activity 8 - Pad footing construction (from D12 to D18)	107	68		65																				
D12	Activity 9 - Pier construction for D12 to D17	107	68		66																				
D13	Activity 8 - Pad footing construction (from D12 to D18)	107	37		70																				
D13	Activity 9 - Pier construction for D12 to D17	107	37		70																				
D14	Activity 8 - Pad footing construction (from D12 to D18)	107	24		74																				
D14	Activity 9 - Pier construction for D12 to D17	107	24		74																				
D15	Activity 8 - Pad footing construction (from D12 to D18)	107	48		69																				
D15	Activity 9 - Pier construction for D12 to D17	107	48		69																				
D16	Activity 8 - Pad footing construction (from D12 to D18)	107	79		64																				
D16	Activity 9 - Pier construction for D12 to D17	107	79		64																				
D17	Activity 8 - Pad footing construction (from D12 to D18)	107	117		60																				
D17	Activity 9 - Pier construction for D12 to D17	107	117		60																				
D18	Activity 8 - Pad footing construction (from D12 to D18)	107	149		58																				
D18	Activity 9 - Pier construction for D12 to D17	107	149		58																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	316	Out of 300m	0																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	281		53																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	245		54																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	202		55																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	167		58																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	136		60																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	99		62																				
D6	Activity 1 - Tree felling, hoarding / fence erection, access to	107	68		65																				
D6	Activity 2 - Slope improvement (from D6 to D8)	105	316	Out of 300m	0																				
D6	Activity 3 - Slope improvement (from D5 to D8)	105	281		55																				
D6	Activity 3 - Slope improvement (from D5 to D8)	105	245		56																				
D6	Activity 3 - Slope improvement (from D5 to D8)	105	202		58																				
D11	Activity 6 - Tree felling, hoarding / fence erection, access to	105	99		60																				
D12	Activity 7 - Slope improvement (from D12 to D18)	107	68		63																				
D13	Activity 7 - Slope improvement (from D12 to D18)	107	37		69																				
D14	Activity 7 - Slope improvement (from D12 to D18)	107	24		72																				
D15	Activity 7 - Slope improvement (from D12 to D18)	107	48		66																				
D16	Activity 7 - Slope improvement (from D12 to D18)	107	79		62																				
D17	Activity 7 - Slope improvement (from D12 to D18)	107	117		59																				
D18	Activity 7 - Slope improvement (from D12 to D18)	107	149		57																				
D12	Activity 7 - Slope improvement (from D12 to D18)	107	68		65																				
D13	Activity 7 - Slope improvement (from D12 to D18)	107	37		71																				
D14	Activity 7 - Slope improvement (from D12 to D18)	107	24		74																				
D15	Activity 7 - Slope improvement (from D12 to D18)	107	48		68																				
D16	Activity 7 - Slope improvement (from D12 to D18)	107	79		64																				
D17	Activity 7 - Slope improvement (from D12 to D18)	107	117		61																				
D18	Activity 7 - Slope improvement (from D12 to D18)	107	149		59																				
D6	Activity 10 - Segment erection (from D18 to D5)	105	316	Out of 300m	0																				
D6	Activity 10 - Segment erection (from D18 to D5)	105	281		51																				
D6	Activity 10 - Segment erection (from D18 to D5)	105	245		52																				
D6	Activity 10 - Segment erection (from D18 to D5)	105	202		53																				
D6	Activity 10 - Segment erection (from D18 to D5)	105	167		56																				
D10	Activity 10 - Segment erection (from D18 to D5)	105	136		57																				
D11	Activity 10 - Segment erection (from D18 to D5)	105	99		59																				
D12	Activity 10 - Segment erection (from D18 to D5)	105	68		60																				
D13	Activity 10 - Segment erection (from D18 to D5)	105	37		69																				
D14	Activity 10 - Segment erection (from D18 to D5)	105	24		73																				
D15	Activity 10 - Segment erection (from D18 to D5)	105	48		66																				
D16	Activity 10 - Segment erection (from D18 to D5)	105	79		62																				
D17	Activity 10 - Segment erection (from D18 to D5)	105	117		59																				
D18	Activity 10 - Segment erection (from D18 to D5)	105	149		57																				
D13	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	37		68																				
D14	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	24		73																				
D15	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	48		67																				
D16	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	79		63																				
D17	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	117		59																				



Appendix B  
Construction Airborne Noise Assessment (Mitigated Scenario)

NSR HSS1		SWL at Each Pier	Distance from NSR	Remarks	Attenuated SPL at NSR	2013											
Work Site	Activity					Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Vaduct D (WCH to ACB) - Piers D4 to D18/E1																	
D5	Activity 2 - Bored piling at D5 to D11	105	316	Out of 300m	0												
D5	Activity 3 - Pilecap construction at D5 to D11	105	316	Out of 300m	0												
D5	Activity 4 - Pier construction for D5 to D11	104	316	Out of 300m	0												
D6	Activity 2 - Bored piling at D6 to D11	105	281		51												
D6	Activity 3 - Pilecap construction at D6 to D11	106	281		52												
D6	Activity 4 - Pier construction for D6 to D11	104	281		50												
D7	Activity 2 - Bored piling at D7 to D11	105	245		53												
D7	Activity 3 - Pilecap construction at D7 to D11	106	245		54												
D7	Activity 4 - Pier construction for D7 to D11	104	245		51												
D8	Activity 2 - Bored piling at D8 to D11	105	202		54												
D8	Activity 3 - Pilecap construction at D8 to D11	106	202		55												
D8	Activity 4 - Pier construction for D8 to D11	104	202		53												
D9	Activity 2 - Bored piling at D9 to D11	105	167		56												
D9	Activity 3 - Pilecap construction at D9 to D11	106	167		57												
D9	Activity 4 - Pier construction for D9 to D11	104	167		55												
D10	Activity 2 - Bored piling at D10 to D11	105	136		58												
D10	Activity 3 - Pilecap construction at D10 to D11	106	136		59												
D10	Activity 4 - Pier construction for D10 to D11	104	136		56												
D11	Activity 2 - Bored piling at D11 to D11	105	99		60												
D11	Activity 3 - Pilecap construction at D11 to D11	106	99		62												
D11	Activity 4 - Pier construction for D11 to D11	104	99		59												
D12	Activity 8 - Pad footing construction (from D12 to D18)	107	68		65												
D12	Activity 9 - Pier construction for D12 to D17	107	68		69												
D13	Activity 8 - Pad footing construction (from D12 to D18)	107	37		70												
D13	Activity 9 - Pier construction for D12 to D17	107	37		72												
D14	Activity 8 - Pad footing construction (from D12 to D18)	107	24		74												
D14	Activity 9 - Pier construction for D12 to D17	107	24		74												
D15	Activity 8 - Pad footing construction (from D12 to D18)	107	48		69												
D15	Activity 9 - Pier construction for D12 to D17	107	48		69												
D16	Activity 8 - Pad footing construction (from D12 to D18)	107	79		64												
D16	Activity 9 - Pier construction for D12 to D17	107	79		64												
D17	Activity 8 - Pad footing construction (from D12 to D18)	107	117		60												
D17	Activity 9 - Pier construction for D12 to D17	107	117		60												
D18	Activity 8 - Pad footing construction (from D12 to D18)	107	149		58												
D18	Activity 9 - Pier construction for D12 to D17	107	149		58												
D9	Activity 1 - Tree felling, hoarding / fence erection, access for	107	316	Out of 300m	0												
D9	Activity 2 - Tree felling, hoarding / fence erection, access for	107	281		53												
D9	Activity 3 - Tree felling, hoarding / fence erection, access for	107	245		54												
D9	Activity 4 - Tree felling, hoarding / fence erection, access for	107	202		55												
D9	Activity 5 - Tree felling, hoarding / fence erection, access for	107	167		56												
D9	Activity 6 - Tree felling, hoarding / fence erection, access for	107	136		57												
D9	Activity 7 - Tree felling, hoarding / fence erection, access for	107	99		62												
D9	Activity 8 - Slope improvement (from D9 to D9)	105	316	Out of 300m	0												
D9	Activity 9 - Slope improvement (from D9 to D9)	105	281		55												
D9	Activity 10 - Slope improvement (from D9 to D9)	105	245		56												
D9	Activity 11 - Slope improvement (from D9 to D9)	105	202		58												
D11	Activity 6 - Tree felling, hoarding / fence erection, access for	105	99		60												
D12	Activity 6 - Tree felling, hoarding / fence erection, access for	105	68		63												
D13	Activity 6 - Tree felling, hoarding / fence erection, access for	105	37		69												
D14	Activity 6 - Tree felling, hoarding / fence erection, access for	105	24		72												
D15	Activity 6 - Tree felling, hoarding / fence erection, access for	105	48		66												
D16	Activity 6 - Tree felling, hoarding / fence erection, access for	105	79		62												
D17	Activity 6 - Tree felling, hoarding / fence erection, access for	105	117		59												
D18	Activity 6 - Tree felling, hoarding / fence erection, access for	105	149		57												
D12	Activity 7 - Slope improvement (from D12 to D18)	107	68		65												
D13	Activity 7 - Slope improvement (from D12 to D18)	107	37		71												
D14	Activity 7 - Slope improvement (from D12 to D18)	107	24		74												
D15	Activity 7 - Slope improvement (from D12 to D18)	107	48		68												
D16	Activity 7 - Slope improvement (from D12 to D18)	107	79		64												
D17	Activity 7 - Slope improvement (from D12 to D18)	107	117		61												
D18	Activity 7 - Slope improvement (from D12 to D18)	107	149		59												
D9	Activity 10 - Segment erection (from D18 to D5)	105	316	Out of 300m	0												
D9	Activity 10 - Segment erection (from D18 to D5)	105	281		51												
D9	Activity 10 - Segment erection (from D18 to D5)	105	245		52												
D9	Activity 10 - Segment erection (from D18 to D5)	105	202		54												
D9	Activity 10 - Segment erection (from D18 to D5)	105	167		56												
D10	Activity 10 - Segment erection (from D18 to D5)	105	136		57												
D11	Activity 10 - Segment erection (from D18 to D5)	105	99		60												
D12	Activity 10 - Segment erection (from D18 to D5)	105	68		63												
D13	Activity 10 - Segment erection (from D18 to D5)	105	37		69												
D14	Activity 10 - Segment erection (from D18 to D5)	105	24		72												
D15	Activity 10 - Segment erection (from D18 to D5)	105	48		66												
D16	Activity 10 - Segment erection (from D18 to D5)	105	79		62												
D17	Activity 10 - Segment erection (from D18 to D5)	105	117		59												
D18	Activity 10 - Segment erection (from D18 to D5)	105	149		57												
D13	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	37		68												
D14	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	24		73												
D15	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	48		67												
D16	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	79		63												
D17	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	117		60												
D18	Activity 11 - Cast In-situ Decking (from D18 to D13)	106	149		57												
D8	Activity 12 - Noise barrier erection (from D18 to D5)	101	316	Out of 300m	0												
D9	Activity 12 - Noise barrier erection (from D18 to D5)	101	281		47												
D10	Activity 12 - Noise barrier erection (from D18 to D5)	101	245		48												
D11	Activity 12 - Noise barrier erection (from D18 to D5)	101	202		50												
D12	Activity 12 - Noise barrier erection (from D18 to D5)	101	167		52												
D13	Activity 12 - Noise barrier erection (from D18 to D5)	101	136		54												
D14	Activity 12 - Noise barrier erection (from D18 to D5)	101	99		56												
D15	Activity 12 - Noise barrier erection (from D18 to D5)	101	68		59												
D16	Activity 12 - Noise barrier erection (from D18 to D5)	101	37		63												
D17	Activity 12 - Noise barrier erection (from D18 to D5)	101	24		68												
D18	Activity 12 - Noise barrier erection (from D18 to D5)	101	48		62												
D19	Activity 12 - Noise barrier erection (from D18 to D5)	101	79		58												
D17	Activity 12 - Noise barrier erection (from D18 to D5)	101	117		55												
D18	Activity 12 - Noise barrier erection (from D18 to D5)	101	149		53												











Appendix B  
Construction Airborne Noise Assessment (Mitigated Scenario)

NSR HSS4			2011												2012												
Work Site	Activity	SWL at Each Pair	Distance from NSR	Remarks	Attenuated SPL at NSR	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		
Vaduct D (WCH to ACB) - Piers D4 to D18E1																											
D5	Activity 2 - Bored piling at D5 to D11	105	363	Out of 300m	0														0	0							
D5	Activity 3 - Pilecap construction at D5 to D11	104	363	Out of 300m	0																0	0					
D5	Activity 4 - Pier construction for D5 to D11	104	363	Out of 300m	0																	0	0				
D5	Activity 2 - Bored piling at D5 to D11	105	329	Out of 300m	0														0	0	0						
D5	Activity 3 - Pilecap construction at D5 to D11	104	329	Out of 300m	0																0	0	0				
D5	Activity 4 - Pier construction for D5 to D11	104	329	Out of 300m	0																	0	0				
D7	Activity 2 - Bored piling at D5 to D11	105	296	51													51	51	51								
D7	Activity 3 - Pilecap construction at D5 to D11	104	296	52																		52					
D7	Activity 4 - Pier construction for D5 to D11	104	296	50																			50	50			
D8	Activity 2 - Bored piling at D5 to D11	105	250	52														52	52								
D8	Activity 3 - Pilecap construction at D5 to D11	104	250	53																			53	53			
D8	Activity 4 - Pier construction for D5 to D11	104	250	51																				51	51		
D9	Activity 2 - Bored piling at D5 to D11	105	224	53																				53	53		
D9	Activity 3 - Pilecap construction at D5 to D11	104	224	54																					54	54	
D9	Activity 4 - Pier construction for D5 to D11	104	224	52																						52	52
D10	Activity 2 - Bored piling at D5 to D11	105	196	54																							
D10	Activity 3 - Pilecap construction at D5 to D11	104	196	55																							
D10	Activity 4 - Pier construction for D5 to D11	104	196	53																							
D11	Activity 2 - Bored piling at D5 to D11	105	164	55																							
D11	Activity 3 - Pilecap construction at D5 to D11	104	164	57																							
D11	Activity 4 - Pier construction for D5 to D11	104	164	55																							
D12	Activity 8 - Pad footing construction (from D12 to D18)	107	137	59																							
D12	Activity 9 - Pier construction for D12 to D17	107	137	59																							
D13	Activity 8 - Pad footing construction (from D12 to D18)	107	112	61																							
D13	Activity 9 - Pier construction for D12 to D17	107	112	61																							
D14	Activity 8 - Pad footing construction (from D12 to D18)	107	85	63																							
D14	Activity 9 - Pier construction for D12 to D17	107	85	63																							
D15	Activity 8 - Pad footing construction (from D12 to D18)	107	71	65																							
D15	Activity 9 - Pier construction for D12 to D17	107	71	65																							
D16	Activity 8 - Pad footing construction (from D12 to D18)	107	66	65																							
D16	Activity 9 - Pier construction for D12 to D17	107	66	65																							
D17	Activity 8 - Pad footing construction (from D12 to D18)	107	79	64																							
D17	Activity 9 - Pier construction for D12 to D17	107	79	64																							
D18	Activity 8 - Pad footing construction (from D12 to D18)	107	99	62																							
D18	Activity 9 - Pier construction for D12 to D17	107	99	62																							
D5	Activity 1 - Tree felling, hoarding / fence erection, access for	107	363	Out of 300m	0																						
D5	Activity 2 - Tree felling, hoarding / fence erection, access for	107	329	Out of 300m	0																						
D5	Activity 3 - Tree felling, hoarding / fence erection, access for	107	296	53																							
D5	Activity 4 - Tree felling, hoarding / fence erection, access for	107	250	54																							
D5	Activity 5 - Tree felling, hoarding / fence erection, access for	107	224	55																							
D5	Activity 6 - Tree felling, hoarding / fence erection, access for	107	196	56																							
D5	Activity 7 - Tree felling, hoarding / fence erection, access for	107	164	58																							
D5	Activity 8 - Tree felling, hoarding / fence erection, access for	107	137	59																							
D5	Activity 9 - Tree felling, hoarding / fence erection, access for	107	112	61																							
D5	Activity 10 - Tree felling, hoarding / fence erection, access for	107	85	63																							
D5	Activity 11 - Tree felling, hoarding / fence erection, access for	107	71	65																							
D5	Activity 12 - Tree felling, hoarding / fence erection, access for	107	66	65																							
D5	Activity 13 - Tree felling, hoarding / fence erection, access for	107	66	65																							
D5	Activity 14 - Tree felling, hoarding / fence erection, access for	107	79	64																							
D5	Activity 15 - Tree felling, hoarding / fence erection, access for	107	99	62																							
D5	Activity 16 - Tree felling, hoarding / fence erection, access for	107	99	62																							
D5	Activity 17 - Tree felling, hoarding / fence erection, access for	107	127	60																							
D5	Activity 18 - Tree felling, hoarding / fence erection, access for	107	154	57																							
D5	Activity 19 - Tree felling, hoarding / fence erection, access for	107	181	54																							
D5	Activity 20 - Tree felling, hoarding / fence erection, access for	107	208	51																							
D5	Activity 21 - Tree felling, hoarding / fence erection, access for	107	235	48																							
D5	Activity 22 - Tree felling, hoarding / fence erection, access for	107	262	45																							
D5	Activity 23 - Tree felling, hoarding / fence erection, access for	107	289	42																							
D5	Activity 24 - Tree felling, hoarding / fence erection, access for	107	316	39																							
D5	Activity 25 - Tree felling, hoarding / fence erection, access for	107	343	36																							
D5	Activity 26 - Tree felling, hoarding / fence erection, access for	107	370	33																							
D5	Activity 27 - Tree felling, hoarding / fence erection, access for	107	397	30																							
D5	Activity 28 - Tree felling, hoarding / fence erection, access for	107	424	27																							
D5	Activity 29 - Tree felling, hoarding / fence erection, access for	107	451	24																							
D5	Activity 30 - Tree felling, hoarding / fence erection, access for	107	478	21																							
D5	Activity 31 - Tree felling, hoarding / fence erection, access for	107	505	18																							
D5	Activity 32 - Tree felling, hoarding / fence erection, access for	107	532	15																							
D5	Activity 33 - Tree felling, hoarding / fence																										







Annex B

CNMMP for Contract No.  
907 (Wong Chuk Hang  
Depot Site Formation and  
Piling)



**C907**

# Noise Mitigation Measures Plan

Prepared By:

Approved By:

Revision: 6

Date: 3 Aug 2011

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Environmental Officer  
H. Y. Tang

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Project Manager  
Patrick Wong

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- Figure 2.1 300m study areas of NSRs
- Figure 2.2 Overall site layout and works area
- Figure 3.1 Schematic drawing of noise enclosure

### Appendices

- Appendix A Construction Schedule and Plant Inventory
- Appendix B Construction Air-borne Noise Assessment (Mitigation Scenario)

## 1. Introduction

- 1.1 In December 2007, the Government gave the approval for the MTR Corporation Limited (MTRCL) to proceed with preliminary planning and design of the South Island Line eastern section (SIL(E)). The SIL(E) (The Project) will be a medium capacity railway that measures a total length of approximately 7 km. It will run from Admiralty to South Horizons, with three intermediate stations at Ocean Park, Wong Chuk Hang and Lei Tung.
- 1.2 The construction of the South Island Line (East) has been divided into a series of Contracts and Contract 907 comprise the site formation, excavation, temporary retaining structures and piling works for the Wong Chuk Hang Depot located at the former Wong Chuk Hang Estate, utility diversions within Police School Road and Nam Long Shan Road, a temporary bus terminus along Nam Long Shan Road and a temporary barging facility at Lee Nam Road.
- 1.3 The South Island Line (East) Environmental Impact Assessment (SIL(E) EIA) Report for the Project was submitted and subsequently approved with conditions by the Environmental Protection Department (EPD) on 26 Oct 2010.
- 1.4 Condition 2.9 of the approved Environmental Permit (EP. 407/2010) stated that: *To further reduce the construction noise impacts on the 12 noise sensitive receivers (NSRs) with predicted exceedance in air-borne construction noise and the 2 NSRs with predicted exceedance in ground-borne construction noise in the approved EIA Report, the Permit Holder shall, at least one month before commencement of construction of the project, submit to the Director for approval four hard copies and one electronic copy of a construction noise mitigation measures plan*
- 1.5 Environmental Impact Assessment Process (EIAO) and Noise Control Ordinance (NCO) provide the statutory framework for noise control. Pursuant to Technical Memorandum of EIA, noise standard for daytime construction activities as list in **Table 1.1**

**Table 1.1 Noise standards for daytime construction activities**

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

- 1.6 Of the 12 NSRs covered by the SIL(E) EIA and required to be included in the NMMP by the EP, only 3 of them are relevant to C907, namely Singapore International School (SIS1), Planned Singapore International School (Extensions) (SIS2) and San Wui Commercial Society of HK Chan Pak Sha School (CPS) . The EIA predicted that these NSRs, assigned

as SIS1, SIS2 and CPS, would suffer from construction airborne noise impacts up to a maximum of 76 dB(A). As these NSRs are classified as an institutional NSRs, residual impacts are therefore up to 6 dB(A). The locations of the NSRs and SIL(E) alignment under C907 are shown in **Figure 1.1**.

- 1.7 This NMMP is prepared to comply with Condition 2.9 of the SIL(E) EP and presents the following information as required by the EP:
- a schedule of construction works to be carried out at the works areas of the Project within 300m from the NSRs SIS1, SIS2 and CPS;
  - an updated construction methodology of the proposed construction works;
  - an updated powered mechanical equipment (PME) list for the proposed construction works;
  - an updated prediction of noise levels in accordance with the above updated information and mitigation proposals in place.

## 2. Description of the Construction Works in the Study Area

2.1 The 300m study areas of CPS, SIS1 and SIS2 are shown in **Figure 2.1**. The major scopes of works comprise but not limited to the following:

- (a) Site formation in soil and rock;
- (b) Excavation and temporary retaining structures;
- (c) Demolition and removal of existing foundations of the structures associated with the former Wong Chuk Hang Housing Estate;
- (d) Large diameter bored piling;
- (e) Utility diversions, improvements to existing utilities and TTM schemes to facilitate construction;
- (f) Site formation and roadworks including temporary slope cutting & sheet piling, gabion wall construction & backfilling, drainage, traffic aids, road markings, lighting and signage for temporary bus terminus at Nam Long Shan Road;
- (g) Tree clearance at the former Wong Chuk Hang Estate, and;
- (h) Conduct soil resistivity tests at the proposed earthing mat locations.
- (i) Provision and operation of a temporary barging facility at Lee Nam Road.

### Construction Methodology

2.2 The proposed construction methodology generally involves utilities diversion, hoarding erection and removal of trees and the top hard materials. After that, a large portion of works area at the depot centre will be excavated to the proposed formation levels by a combination of blasting and non-blasting methods. Temporary pipe pile walls will be installed along the site perimeter, and permanent bored piles will be constructed in different zones. The different zone is shown in **Figure 2.2**

2.3 Construction of barging facility is out of 300m from NSR CPS, SIS1 and SIS2, therefore, the construction noise impact will not be considered.

2.4 A breakdown of the major construction activities to be carried out within 300m of the NSRs are shown below and detailed in **Appendix A**.

### Phase 1

- Activity 1 . Tree felling, hoarding / fence erection, access formation, etc.
- Activity 2 . Utilities diversion at Public Light Bus Stop (PLB)
- Activity 3 . Bored piling at 907.W3B
- Activity 4 . Site formation

## Phase 2

- Activity 5 . Site formation
- Activity 6 . TTM for noise barrier demolition at 907.W2, 907.W3A
- Activity 7 . Bored piling at 907.W3B
- Activity 8 . Pipe pile wall at 907.W2, 907.W3A, 907.W3B, 907.W3C and PLB
- Activity 9 . Utilities diversion at PLB and Public Transport Interchange (PTI)
- Activity 10 . Rock crushing at 907.W1

## Phase 3

- Activity 11 . Pipe pile wall at 907.W2, 907.W3A, 907.W3B, 907.W3C and PLB
- Activity 12 . Bored piling at 907.W3B
- Activity 13 . Site formation

## Phase 4 & 5

- Activity 14 . Site formation

## Other Activity

- Construction of temporary bus terminus at 907.W5

## Construction Schedule

2.5 **Appendix A** and **Table 2.1** demonstrate that multi-phase construction schedules will be implemented for the project. Proactive planning of working sequences could minimize the total sound power levels generated by PMEs during normal daytime working hours.

**Table 2.1 Main construction elements in different phases of construction schedule**

Phase	Working Sequence	Duration	Main Construction Elements
1	Activities 1 to 4	Apr 2011 to July 2011	Forming access road, Tree felling & clearance, Hoarding / Fence erection, Utilities diversion, Bored piling, Site formation
2	Activities 5 to 10	Aug 2011 to Jan 2012	Noise barrier demolition, Pile piling, Bored piling, Works for temporary bus terminus, Rock crushing, Utilities diversion, Site formation
3	Activities 11 and 13	Feb 2012 to Apr 2012	Pile piling, Bored piling, Site formation
4	Activities 14	May 2012 to Aug 2012	Site formation work including installation of the soil nail and strutting system
5	Activities 14	Sep 2012 to Nov 2012	Site formation work includes the temporary drainage

### Updated Powered Mechanical Equipment List

2.6 The updated Powered Mechanical Equipment (PME) list for the construction works is provided in **Table 2.2** below, these PME's are available in Hong Kong market.

**Table 2.2 Updated PME List for the Construction Works**

PME	TM or BS Reference	SWL/unit, dB(A)
Mobile / crawler crane	BS5228 Table D.7/114	101
Excavator (45kW)	BS5228 Table D.3/35	106
Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	110
Dump truck (24 Ton)	BS5228 Table D.9/39	103
Air compressor (flow >10m <sup>3</sup> /min & ≤ 30m <sup>3</sup> /min.)	CNP 002	102
Oscillator	CNP 165	115
Reverse Circulation Drill	BS5228 Table D.10/3	114
Hydraulic Drill Rig	CNP 072	110
Dump truck with grab	CNP 069	105
Generator	CNP 103	95
Water pump (electric)	CNP 281	88
Concrete mixer truck	BS5228 Table D.6/35	100
Vibratory poker (petrol type)	BS5228 Table D.6/40	98
Crane lorry (17 Ton jib)	BS5228 Table D.7/114	101
Rock crusher	Anderson Road EIA	118
Hand. held pneumatic breaker	CNP 025	111

### 3. Noise Assessment and Proposed Mitigation Measures

#### Assessment Methodology and Assumptions

- 3.1 The construction noise assessment has been carried out in accordance to the methodology used in the approved SIL(E) EIA. Notional source distances have been measured at the relevant construction activity.
- 3.2 All proposed mitigation measures in this NMMP and their effectiveness have been previously adopted in the SIL(E) EIA and silent plant, noise barriers, including movable barriers and enclosure/sheds, and acoustic fabric have been considered.

Noise barrier combined with 50mm thick acoustic materials at the side facing the plants fixed on 10mm thick steel have been applied on most plants on site and noise enclosure with same configuration will be applied to rock crusher plant, schematic drawing of the noise enclosure and the mitigation measures for each plant were presented in **Figure 3.1** and **Appendix A** respectively.

#### Noise Assessment Results for Contract 907 and Proposed Mitigation Strategy

The calculated assessment results for Contract 907 are presented in **Appendix B** and summarised in **Table 3.1** below, by the implementation of noise barriers, enclosures/sheds and acoustic fabric for the PME's and rescheduling the construction works as far as possible to avoid cumulative impacts, the maximum construction noise impact at CPS can be reduced to 75 dB(A). The construction programme is arranged in order to minimize the effect to the NSRs.

**Table 3.1 Updated Mitigated Construction Noise Impact at Respective NSRs for Contract 907**

NSRs	Maximum Noise Impact from SIL(E)		Range of exceedance, dB(A)	Duration of residual impact, weeks	
	Revised Scenario	EIA Assessed Scenario		1 to 4 dB(A)	≥5 dB(A)
SIS1	71	71	1	4	0
SIS2	74	74	3-4	20	0
CPS	75	76	1-5	24	4

Note: SIS2 propose to commence for use at September 2011

#### Cumulative Impact

- 3.3 Other activity involve the construction of temporary bus terminus at 907.W5, the construction period is from Aug 2011 to Sept 2011 with the PME show in **Appendix A**

The effect to the NSR is shown in **Table 3.2**:

**Table 3.2 Effect of construction of temporary bus terminus to NSRs**

NSR	Distance (m)	Attenuated SPL at NSR	SPL dB(A) at NSR
SIS1	48	42	66
SIS2	62	44	64
CPS	62	44	64

- 3.4 During the construction period of Contract 907, construction work at Contract 903 such as bored piling and site formation will have a cumulative impact to the NSRs, **Appendix A** show the plant list and construction schedule for Contract 903:  
The worse case scenario of the Contract 903 to NSR is shown in **Table 3.3**:

**Table 3.3 The worse case scenario of Contract 903 to NSR**

NSR	Distance (m)	Attenuated SPL at NSR	SPL dB(A) at NSR
SIS1	303	0	Out of 300m
SIS2	287	57	53
CPS	213	55	55

- 3.5 The worst case scenario of the cumulative impact occurred at Aug 11 to Sep 11, **Table 3.4** show the predicted cumulative construction impact

**Table 3.4 The worst case scenario of the cumulative impact of construction of bus terminus, Contract 903 and Contract 907 during Aug 2011 to Sept 2011 to NSR:**

NSR	Maximum Noise Impact from 907	Maximum Noise Impact from 903	Maximum Noise Impact from construction of bus terminus	SPL dB(A) at NSR
SIS1	69	0	66	71
SIS2	74	53	64	74
CPS	70	55	64	71

Based on the assessment result of the cumulative impact during Aug 2011 to Sep 2011, the contribution from the bus terminus and C903 is considered to be minor. Even minor exceedance recorded, it is within the worst case scenario, and the duration is only 2 months (1 month within the summer holiday), thus, the impact is considered to be acceptable, and the Contractor would implement all necessary mitigation measure in order to minimize the construction impact.

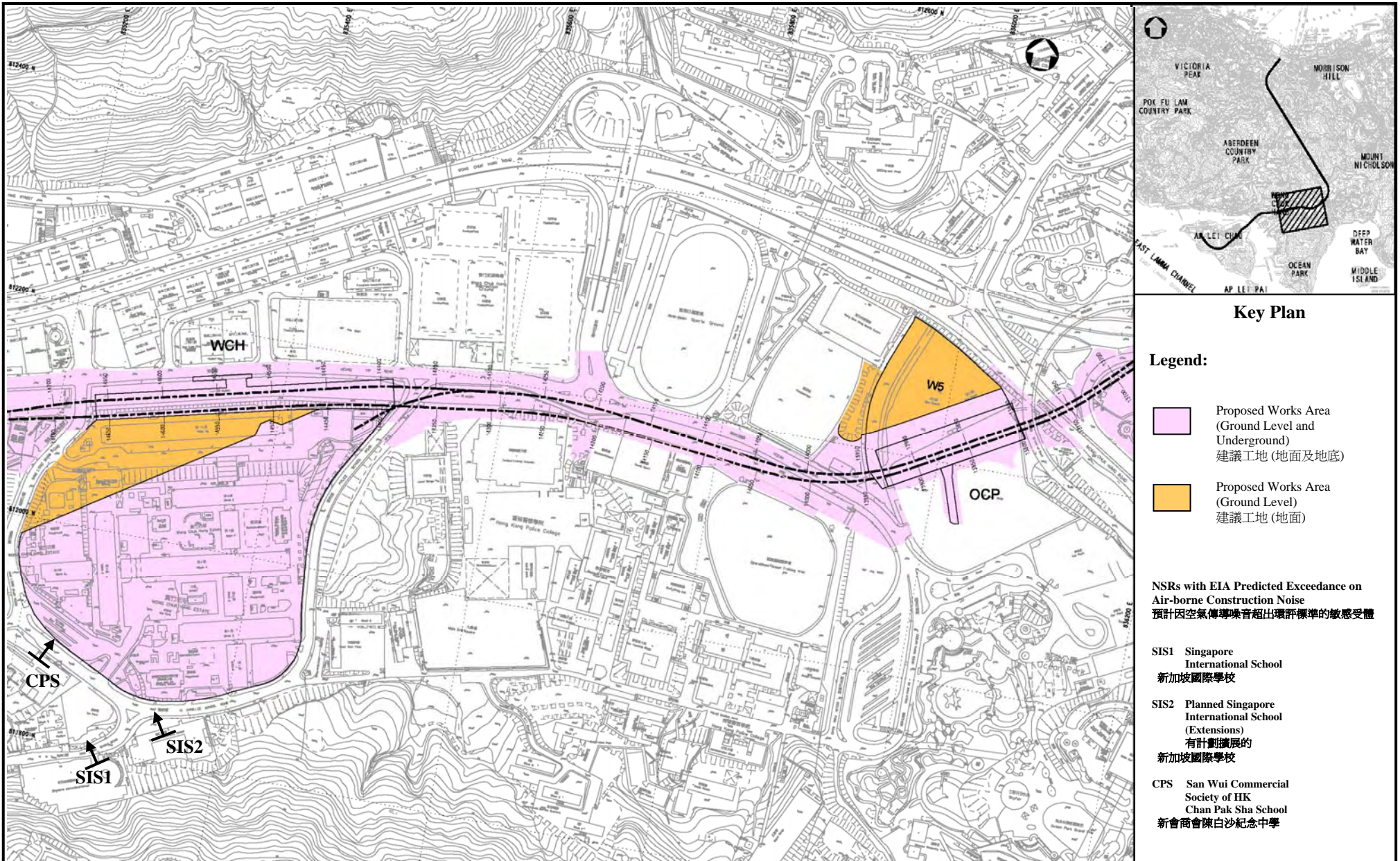
- 3.6 It should be noted that the use of Indirect Technical Remedies (ITR) as a mitigation measure is neither a requirement stipulated under Annex 13 of the EIAO-TM nor the EIA Study Brief. The provision of ITR is the initiative of the Project Proponent in view of the noise disturbance associated with the construction of the SIL(E). Consideration will be given to make reference to the previous approved EIA of WIL for the eligibility criteria proposed for qualifying NSRs for ITR which would be dependent on the severity of the residual noise impact and duration of exceedance after implementing all practical direct mitigation measures.

- 3.8 CPS also agrees that the windows of the New Phase classrooms do not need to be retro-fitted with double glazing (or retro-fitted with other equivalent measures).
- 3.9 Therefore, the following options have been suggested:
- i. Classrooms located within the Old Phase which windows facing the works area, install double glazing (or other equivalent measures)
  - ii. MTR will subsidize the additional electricity charges for the existing air conditioning units which are incurred in excess of the normal daily operations.
- 3.10 CPS agree to accept (ii) option provided by MTR
- 3.11 In order to reduce the excessive noise impacts at the affected NSRs during normal daytime working hours, mitigation measures such as implementing quiet powered mechanical equipment, movable noise barriers, good site practices and multi-phased construction schedules are recommended.
- 3.13 To alleviate the construction noise impact on the affected NSRs, movable noise barriers are proposed to be provided for particular items of plant and construction works. It is anticipated that a movable noise barrier comprised of minimum 50mm thick sound absorbing lining and 10mm thick plywood (or 1mm thick steel) backing with a cantilevered upper portion located within 5m from any static or mobile plant, that PME will be totally/partially screened when viewed from the NSR, a negative correction of 5 dB(A) noise reduction would be achieved. The actual transmission loss of movable noise barrier would be measured on substantiate site condition.
- 3.14 The following good site practices should be adopted to further ameliorate the noise impacts:
- Only well-maintained plant shall be operated on-site and plant shall be serviced regularly during the construction program;
  - Silencers or mufflers on construction equipment shall be utilized and shall be properly maintained during the construction program;
  - Mobile plant, if any, shall be sited as far away from NSRs as applicable;
  - Machines and plant (such as trucks) that may be in intermittent use must be shut down between works periods or shall be throttled down to a minimum;
  - Plant known to emit noise strongly in one direction shall, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and
  - Material stockpiles and other structures shall be effectively utilized, wherever practicable, in screening noise from on-site construction activities.

## 4 Conclusion

- 4.1 With the implementation of the proposed noise mitigation measures, construction noise impacts are now predicted to be reduced.
- 4.2 Further review and update will be performed during the construction phase and liaison with affected parties is essential to minimise the construction noise impacts as far as possible.

**FIGURES 1.1 Locations of NSRs**



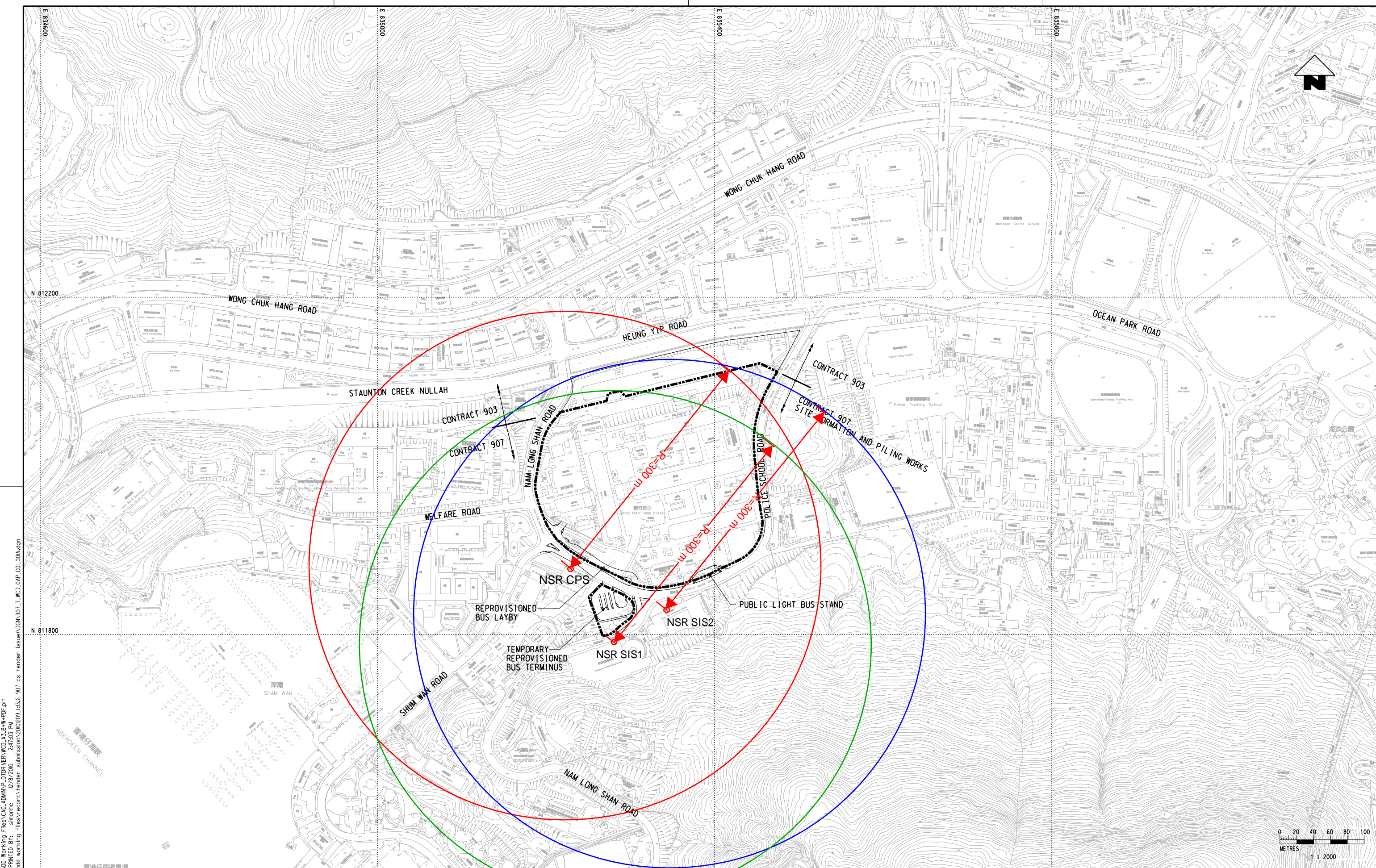
**Project Title : South Island Line (East)**  
**工程項目名稱：南港島綫(東段)**

**Environmental Permit No. : EP-407/2010**  
**環境許可證編號 : EP-407/2010**

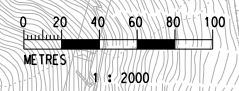
**Noise Sensitive Receivers with EIA Predicted Exceedance**  
**預計超出環評噪音標準的敏感受體**

(This figure was prepared based on Figure 2.6.6 of EIA report (Register No.: AEIAR-155/2010))  
 (本圖是根據環評報告(登記冊編號 AEIAR-155/2010)圖 2.6.6 編制)

**FIGURES 2.1 300m Study Area of NSRs**



P:\Common\907\CADD Working Files\CADD ADMIN\PLOTDRIVER WCD\_A3.B+W+PDF.plt  
 PLOT DRW: simonic 12/8/2009 2:41:03 PM  
 MODELNAME: P:\Common\907\CADD Working Files\record\Tender Submission\20090209\_05.6\_907.cs.tender Issue\CON 907\_T\_WCD\_OAP\_C01\_001A.dgn  
 FILENAME:



REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED
A	TENDER DRAWINGS (REVISION A) ISSUE	AF	06DEC10	DDP					

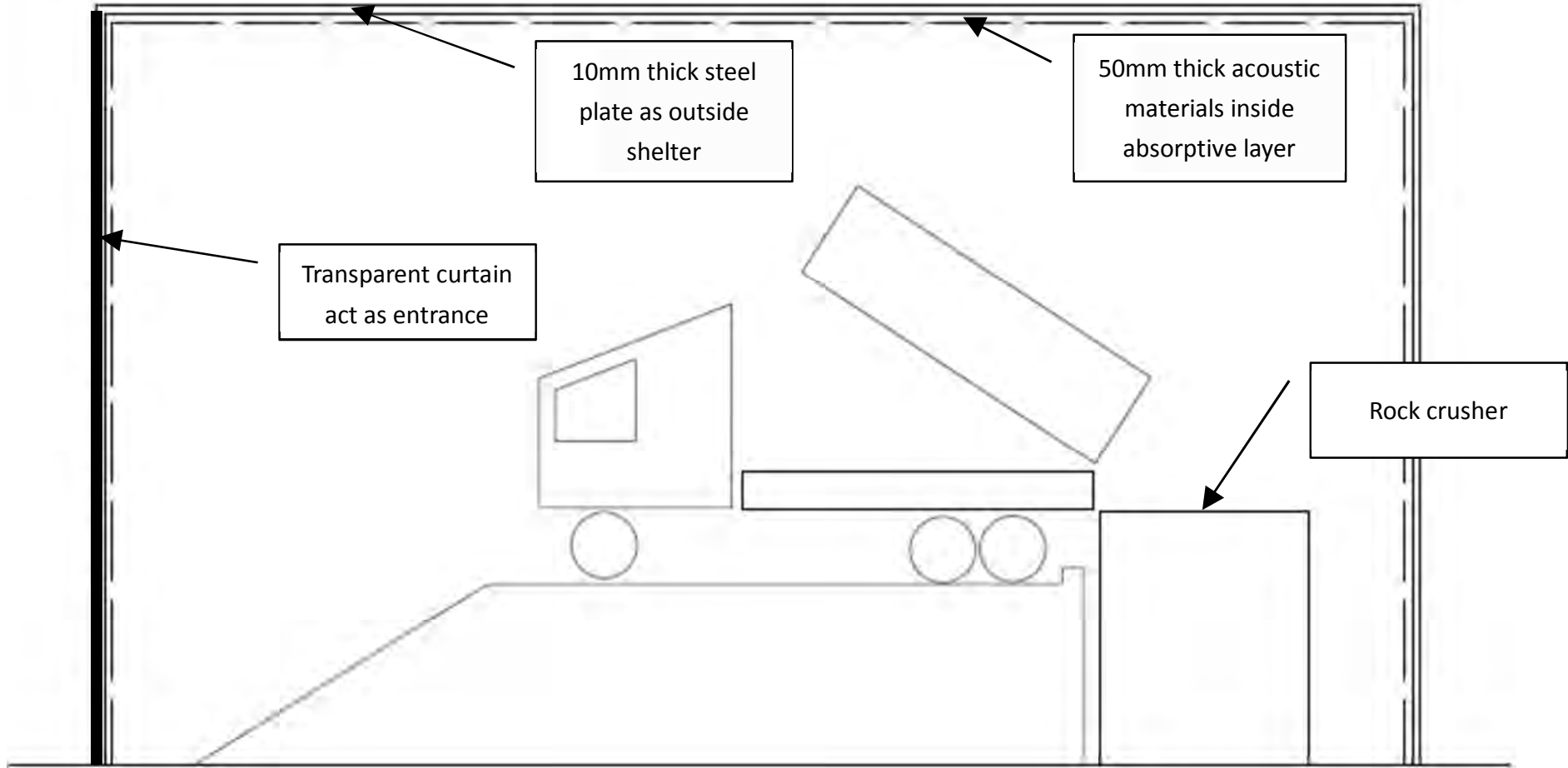
DRAWN	SY		<b>SOUTH ISLAND LINE (EAST)</b> Supported by: Kenneth Ng & Associates Davis Langdon & Seah HK Ltd.	
DESIGNED	AC			
CHECKED	CYH			
APPROVED	DOP			
DATE	28/JUL/2009			
ORIGINATOR 			CADD REF.	907_T_WCD_OAP_C01_001A.dgn

TITLE <b>CONTRACT 907</b> <b>WONG CHUK HANG DEPOT SITE FORMATION &amp; PILING</b> SITE LOCATION PLAN	
SCALE 1 : 2000 (A1)	DRAWING NO. 907/T/WCD/OAP/C01/001
REV.	A

**FIGURES 2.2 Overall site layout and works area**



## FIGURES 3.1 Schematic drawing of noise enclosure



# APPENDICES

## Appendix A

Appendix A  
Construction Schedule and Plant Inventory

Mitigated Plant Inventory

Construction Schedule  
Phase 1

Activity	2011				PME	TM or other reference	No. of PME	SWL, dB(A)/unit	Screening Effect, dB(A)	Noise Mitigation Measures	% on time	Total SWL, dB(A)
	Apr	May	Jun	Jul								
<b>Activity 1 Tree felling, hoarding / fence erection, access formation</b>												
					<b>(Group 1)</b>							
					Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Noise Barrier	80%	100
					Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Noise Barrier	25%	99
					Hand-held pneumatic breaker	CNP 025	2	111	-10	Movable Noise Barrier	20%	97
					Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure/Shed	100%	87
					Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			40%	99
					Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5	Movable Noise Barrier	30%	91
										<b>Total</b>	<b>105</b>	
					<b>(Group 2)</b>							
					Excavator (45kW)	BS 5228 Table D.3/35	1	106	-5	Movable Noise Barrier	70%	99
					Mobile / crawler crane	BS 5228 Table D.7/114	1	101			70%	99
					Dump truck with grab	CNP 069	1	105			40%	101
										<b>Total</b>	<b>105</b>	
					<b>(Group 3)</b>							
					Excavator (45kW)	BS 5228 Table D.3/35	1	106			30%	101
					Welding set (electric)	Not a PME	2	0			50%	0
					Crane lorry (17 Ton jib)	BS 5228 Table D.7/114	1	101			20%	94
					Dump truck (24 Ton)	BS 5228 Table D.9/39	1	103			30%	98
										<b>Total</b>	<b>103</b>	
										<b>Maximum</b>	<b>105</b>	
<b>Activity 2 Utilities diversion at PLB, Existing PTI area and 907.W3B</b>												
					<b>(Group 1)</b>							
					Excavator (45kW)	BS 5228 Table D.3/35	1	106	-5	Movable Noise Barrier	40%	97
					Water pump (electric)	CNP 281	1	88			60%	86
					Crane lorry (17 Ton jib)	BS 5228 Table D.7/114	1	101	-5	Movable Noise Barrier	30%	91
					Concrete mixer truck	BS 5228 Table D.6/35	1	100			30%	95
					Vibratory poker (petrol type)	BS 5228 Table D.6/40	1	98	-10	Movable Noise Barrier	30%	83
										<b>Total</b>	<b>100</b>	
										<b>Maximum</b>	<b>100</b>	
<b>Activity 3 Bored Piling at 907.W3B</b>												
					<b>(Group 1)</b>							
					Dump truck (24 Ton)	BS 5228 Table D.9/39	2	103	-5	Movable Noise Barrier	20%	94
					Oscillator	CNP 165	6	115	-10	Fabric	30%	108
					Reverse Circulation Drill	BS 5228 Table D.10/3	8	114	-10	Fabric	90%	113
					Mobile / crawler crane	BS 5229 Table D.7/114	7	101	-5	Movable Noise Barrier	50%	101
					Water pump (electric)	CNP 281	10	88			70%	96
					Excavator (45kW)	BS 5229 Table D.3/35	2	106	-5	Movable Noise Barrier	30%	99
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	4	95	-5	Movable Noise Barrier	70%	94
					Air compressor (flow >10m3/min, < 30m3/min.)	CNP 002	8	102	-15	Enclosure/Shed	100%	96
					Concrete mixer truck	BS 5229 Table D.6/35	5	100	-5	Movable Noise Barrier	40%	98
										<b>Total</b>	<b>114</b>	
										<b>Maximum</b>	<b>114</b>	
<b>Activity 4 Site formation</b>												
					<b>(Group 1)</b>							
					Excavator (45kW)	BS 5229 Table D.3/35	2	106	-5	Movable Noise Barrier	30%	99
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-5	Movable Noise Barrier	70%	88
					Dump truck (24 Ton)	BS 5228 Table D.9/39	3	103			20%	101
										<b>Total</b>	<b>103</b>	
										<b>Maximum</b>	<b>103</b>	

Appendix A  
Construction Schedule and Plant Inventory

Mitigated Plant Inventory

Construction Schedule  
Phase 2

Activity	2011					2012		PME	TM or other reference	No. of PME	SWL, dB(A)/unit	Screening Effect, dB(A)	Noise Mitigation Measures	% on time	Total SWL, dB(A)
	Aug	Sep	Oct	Nov	Dec	Jan	Feb								
<b>Activity 5 Site formation</b>															
								<b>(Group 1)</b>							
								Excavator (45kW)	BS 5229 Table D.3/35	8	106	-5	Movable Noise Barrier	30%	105
								Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-5	Movable Noise Barrier	70%	88
								Dump truck (24 Ton)	BS 5228 Table D.9/39	7	103			20%	104
														<b>Total</b>	<b>108</b>
														<b>Maximum</b>	<b>108</b>
<b>Activity 6 TTM for noise barrier demolition at 907.W2, 907.W3A</b>															
								<b>(Group 1)</b>							
								Excavator (45kW)	BS5228 Table D.3/35	1	106	-5	Movable Noise Barrier	40%	97
								Hydraulic breaker, excavator mounted, 52kW	BS5228 Table D.8/13	1	110	-5	Movable Noise Barrier	50%	102
								Hand-held pneumatic breaker	CNP 25	2	111	-10	Movable Noise Barrier	20%	97
								Air compressor (flow >10m3/min & <= 30m3/min.)	CNP 002	1	102	-15	Enclosure/Shed	100%	87
								Dump truck (24 Ton)	BS5228 Table D.9/39	1	103			40%	99
								Crane lorry (17 Ton jib)	BS5228 Table D.7/114	1	101	-5	Movable Noise Barrier	20%	89
														<b>Total</b>	<b>105</b>
														<b>Maximum</b>	<b>105</b>
<b>Activity 7 Bored Piling at 907.W3B</b>															
								<b>(Group 1)</b>							
								Dump truck (24 Ton)	BS 5228 Table D.9/39	2	103	-5	Movable Noise Barrier	20%	94
								Oscillator	CNP 165	6	115	-10	Fabric	30%	108
								Reverse Circulation Drill	BS 5228 Table D.10/3	8	114	-10	Fabric	90%	113
								Mobile / crawler crane	BS 5229 Table D.7/114	7	101	-5	Movable Noise Barrier	50%	101
								Water pump (electric)	CNP 281	10	88			70%	96
								Excavator (45kW)	BS 5229 Table D.3/35	2	106	-5	Movable Noise Barrier	30%	99
								Generator, super silenced, 70 dB(A) at 7 m	CNP 103	4	95	-5	Movable Noise Barrier	70%	94
								Air compressor (flow >10m3/min, < 30m3/min.)	CNP 002	8	102	-15	Enclosure/Shed	100%	96
								Concrete mixer truck	BS 5229 Table D.6/35	5	100	-5	Movable Noise Barrier	40%	98
														<b>Total</b>	<b>114</b>
														<b>Maximum</b>	<b>114</b>
<b>Activity 8 Pipe piling at 907.W2, 907.W3A, 907.W3B, 907.W3C and PLB</b>															
								<b>(Group 1)</b>							
								Excavator (45kW)	BS 5229 Table D.3/35	1	106	-5	Movable Noise Barrier	30%	96
								Hydraulic Drill Rig	CNP 072	2	110	-10	Fabric	40%	99
								Mobile / crawler crane	BS 5229 Table D.7/114	1	101	-5	Movable Noise Barrier	50%	93
								Generator, super silenced, 70 dB(A) at 7 m	CNP 103	3	95	-5	Movable Noise Barrier	70%	93
								Air compressor (flow >10m3/min, < 30m3/min.)	CNP 002	3	102	-15	Enclosure/Shed	100%	92
								Water pump (electric)	CNP 281	4	88	0		70%	92
														<b>Total</b>	<b>103</b>
														<b>Maximum</b>	<b>103</b>
<b>Activity 9 Utilities diversion at PLB, Existing PTI area and 907.W3B</b>															
								<b>(Group 1)</b>							
								Excavator (45kW)	BS 5228 Table D.3/35	1	106	-5	Movable Noise Barrier	40%	97
								Water pump (electric)	CNP 281	1	88			60%	86
								Crane lorry (17 Ton jib)	BS 5228 Table D.7/114	1	101	-5	Movable Noise Barrier	30%	91
								Concrete mixer truck	BS 5228 Table D.6/35	1	100			30%	95
								Vibratory poker (petrol type)	BS 5228 Table D.6/40	1	98	-10	Movable Noise Barrier	30%	83
														<b>Total</b>	<b>100</b>
														<b>Maximum</b>	<b>100</b>
<b>Activity 10 Rock Crushing at 907.W1</b>															
								<b>(Group 1)</b>							
								Rock Crusher Plant	Anderson Road EIA	1	118	-15	Enclosure/Shed	100%	103
														<b>Total</b>	<b>103</b>
														<b>Maximum</b>	<b>103</b>

Appendix A  
Construction Schedule and Plant Inventory

Mitigated Plant Inventory

Construction Schedule  
Phase 3

Activity	2012				PME	TM or other reference	No. of PME	SWL, dB(A)/unit	Screening Effect, dB(A)	Noise Mitigation Measures	% on time	Total SWL, dB(A)
	Jan	Feb	Mar	Apr								
<b>Activity 11 Pipe piling at 907.W2, 907.W3A, 907.W3B, 907.W3C and PLB</b>												
					<b>(Group 1)</b>							
					Excavator (45kW)	BS 5229 Table D.3/35	1	106	-5	Movable Noise Barrier	30%	96
					Hydraulic Drill Rig	CNP 072	2	110	-10	Fabric	40%	99
					Mobile / crawler crane	BS 5229 Table D.7/114	1	101	-5	Movable Noise Barrier	50%	93
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	3	95	-5	Movable Noise Barrier	70%	93
					Air compressor (flow >10m3/min, < 30m3/min.)	CNP 002	3	102	-15	Enclosure/Shed	100%	92
					Water pump (electric)	CNP 281	4	88	0		70%	92
											<b>Total</b>	<b>103</b>
											<b>Maximum</b>	<b>103</b>
<b>Activity 12 Bored Piling at 907.W3B</b>												
					<b>(Group 1)</b>							
					Dump truck (24 Ton)	BS 5228 Table D.9/39	2	103	-5	Movable Noise Barrier	50%	98
					Oscillator	CNP 165	3	115	-10	Fabric	50%	107
					Reverse Circulation Drill	BS 5228 Table D.10/3	4	114	-10	Fabric	90%	110
					Mobile / crawler crane	BS 5229 Table D.7/114	4	101	-5	Movable Noise Barrier	50%	99
					Water pump (electric)	CNP 281	5	88			70%	93
					Excavator (45kW)	BS 5229 Table D.3/35	1	106	-5	Movable Noise Barrier	30%	96
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	2	95	-5	Movable Noise Barrier	70%	91
					Air compressor (flow >10m3/min, < 30m3/min.)	CNP 002	4	102	-15	Enclosure/Shed	100%	93
					Concrete mixer truck	BS 5229 Table D.6/35	3	100	-5	Movable Noise Barrier	40%	96
											<b>Total</b>	<b>112</b>
											<b>Maximum</b>	<b>112</b>
<b>Activity 13 Site formation</b>												
					<b>(Group 1)</b>							
					Excavator (45kW)	BS 5229 Table D.3/35	2	106	-5	Movable Noise Barrier	30%	99
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-5	Movable Noise Barrier	70%	88
					Dump truck (24 Ton)	BS 5228 Table D.9/39	3	103			20%	101
											<b>Total</b>	<b>103</b>
											<b>Maximum</b>	<b>103</b>

Appendix A  
Construction Schedule and Plant Inventory

Mitigated Plant Inventory

Construction Schedule  
Phase 4

Activity	2012					PME	TM or other reference	No. of PME	SWL, dB(A)/unit	Screening Effect, dB(A)	Noise Mitigation Measures	% on time	Total SWL, dB(A)
	Apr	May	Jun	Jul	Aug								
Activity 14 Site formation													
						(Group 1)							
						Excavator (45kW)	BS 5229 Table D.3/35	2	106	-5	Movable Noise Barrier	30%	99
						Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-5	Movable Noise Barrier	70%	88
						Dump truck (24 Ton)	BS 5228 Table D.9/39	3	103			20%	101
												<b>Total</b>	<b>103</b>
												<b>Maximum</b>	<b>103</b>

Appendix A  
Construction Schedule and Plant Inventory

Mitigated Plant Inventory

Construction Schedule  
Phase 5

Activity	2012				PME	TM or other reference	No. of PME	SWL, dB(A)/unit	Screening Effect, dB(A)	Noise Mitigation Measures	% on time	Total SWL, dB(A)
	Aug	Sep	Oct	Nov								
Activity 14 Site formation												
					(Group 1)							
					Excavator (45kW)	BS 5229 Table D.3/35	2	106	-5	Movable Noise Barrier	30%	99
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-5	Movable Noise Barrier	70%	88
					Dump truck (24 Ton)	BS 5228 Table D.9/39	3	103			20%	101
											<b>Total</b>	<b>103</b>
											<b>Maximum</b>	<b>103</b>

Appendix A  
Construction Schedule and Plant Inventory

Mitigated Plant Inventory

Construction Schedule  
Construction of temporary bus terminus

Activity	2011				PME	TM or other reference	No. of PME	SWL, dB(A)/unit	Screening Effect, dB(A)	Noise Mitigation Measures	% on time	Total SWL, dB(A)
	Aug	Sep	Oct	Nov								
<b>Construction of temporary bus terminus</b>												
					<b>(Group 1)</b>							
					Excavator (45kW)	BS 5229 Table D.3/35	4	106	-5	Movable Noise Barrier	30%	102
					Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-5	Movable Noise Barrier	70%	88
					Dump truck (24 Ton)	BS 5228 Table D.9/39	4	103			20%	102
											<b>Total</b>	<b>105</b>
											<b>Maximum</b>	<b>105</b>



**Appendix B**





Appendix B  
Construction Airborne Noise Assessment (Mitigated Scenario)

NSR SIS 1 Phase 1					2011										2012										
Work Site	Activity	SWL	Distance (m) from NSR	Remarks	Attenuated SPL at NSR	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
907.W1	Activity 1 – Tree felling, hoarding / fencing	105	265		57	51	51	51	51																
	Activity 4 – Site formation	103	265		57	49	49	49	49																
907.W2	Activity 1 – Tree felling, hoarding / fencing	105	364	Out of 300m	0	0	0	0	0																
	Activity 4 – Site formation	103	364	Out of 300m	0	0	0	0	0																
907. W3A	Activity 1 – Tree felling, hoarding / fencing	105	287		57	51	51	51	51																
	Activity 4 – Site formation	103	225		55	51	51	51	51																
907.W3C	Activity 1 – Tree felling, hoarding / fencing	105	238		56	52	52	52	52																
	Activity 4 – Site formation	103	185		53	53	53	53	53																
PLB	Activity 2 –Utilities diversion	100	131		50			53	53	53	53														
	Activity 4 – Site formation	103	131		50			56	56	56	56														
907.W3B	Activity 1 – Tree felling, hoarding / fencing	105	125		50			58																	
	Activity 3 - Bored Piling	114	125		50			67	67	67															
	Activity 2 –Utilities diversion	100	92		47			56	56	56	56														
	Activity 4 – Site formation	103	132		50			56	56	56	56														
908.W1	Activity 1 – Tree felling, hoarding / fencing	105	275		57			51																	
PTI Area	Activity 1 – Tree felling, hoarding / fencing	105	90		47			61																	
NSR SIS1 Phase 2																									
907.W1	Activity 5 - Site formation	108	265		57					54	54	54	54	54	54	54									
	Activity 10- Rock crushing	103	265		57					49	49	49	49	49	49	49									
907.W2	Activity 5 - Site formation	108	198		54					57	57	57	57	57	57										
	Activity 6 - TTM for noise barrier demolition	105	348	Out of 300m	0					0	0	0	0	0	0										
	Activity 8 - Pipe piling	103	348	Out of 300m	0					0	0	0	0	0	0	0									
907. W3A	Activity 5 - Site formation	108	225		55								56	56	56	56	56	56	56	56					
	Activity 8 - Pipe piling	103	287		57								49	49	49	49	49	49	49	49					
907.W3C	Activity 5 - Site formation	108	185		53					58	58	58	58	58	58	58	58	58	58	58					
	Activity 8 - Pipe piling	103	287		57								49	49	49	49	49	49	49	49					
PLB	Activity 5 - Site formation	108	133		51					60	60	60	60	60	60										
	Activity 8 - Pipe piling	103	120		50					56	56	56	56	56	56	56	56	56	56	56					
	Activity 9 –Utilities diversion	100	131		50					53	53														
907.W3B	Activity 5 – Site formation	108	133		51					60	60	60	60	60	60	60	60	60	60	60					
	Activity 7 - Bored Piling	114	133		51					66	66	66	66	66	66	66	66	66	66	66					
	Activity 8 - Pipe piling	103	82		46					60	60	60	60	60	60	60	60	60	60	60					
	Activity 9 –Utilities diversion	100	92		47					56	56	56	56												
908.W1	Activity 5 - Site formation	108	255		56				55	55	55	55	55	55	55	55	55	55	55						
PTI Area	Activity 5 - Site formation	108	106		49							62	62	62	62										
	Activity 9 –Utilities diversion	100	80		46							57	57												
	Activity 8 - Pipe piling	103	85		46							60	60	60	60	60	60								







Annex C

CNMMP for Contract No.  
904 (Lei Tung Station)



**Noise Mitigation Measures Plan**  
**LET Entrance A and Ground-borne Noise**  
**MTR South Island Line**  
**Contract 904**

**Revision History and Plan Approval**

Revision	Date	Prepared by:	Reviewed by	Approved by:	Section/Description
00	21-06-2011	Stephen Tsang	David Holden	Ken Henderson	First Issue
01	02-08-2011	Stephen Tsang	David Holden	Wes Jones	Second Issue
02	08-08-2011	Stephen Tsang	Brian Shepstone	Wes Jones	Third Issue
03	16-01-2012	Chris Chan	Brian Shepstone	Wes Jones	Include Section 3.16 and 3.17. Amended Section 4.1. Add Figure 3.2

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3	Noise Assessment and Proposed Mitigation Measures .....	9
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### Figures

- Figure 1.1 Locations of NSRs and Alignment Scheme
- Figure 3.1 Building Vibration Response Graph adopted from WIL EIA Report
- Figure 3.2 Photograph of the New Hotel Development

### Appendices

- Appendix A Construction Activities and Plant Inventory
- Appendix B Construction Schedule with Air-borne Noise Assessment (Mitigation Scenario)
- Appendix C Construction Ground-borne Noise Assessment

## 1 Introduction

- 1.1 In December 2007, the Government gave the approval for the MTR Corporation Limited (MTRCL) to proceed with preliminary planning and design of the South Island Line Eastern section (SIL(E)). The SIL(E) (The Project) will be a medium capacity railway that measures a total length of approximately 7 km. It will run from Admiralty to South Horizons, with three intermediate stations at Ocean Park, Wong Chuk Hang and Lei Tung.
- 1.2 The construction of the South Island Line has been divided into a series of Contracts and Contract 904, covering the section of the South Island Line (East) from Aberdeen Channel Bridge to the South Horizon Estate, including a drill and blast tunnel and stations at Lei Tung and South Horizons, respective plant buildings and barging points, was awarded to Leighton - John Holland Joint Venture in May 2011.
- 1.3 The South Island Line (East) Environmental Impact Assessment (SIL(E) EIA) Report for the Project was submitted and subsequently approved with conditions by the Environmental Protection Department (EPD) on 26 Oct 2010.
- 1.4 Condition 2.9 of the approved Environmental Permit (EP-407/2010) stated that: *“To further reduce the construction noise impacts on the 12 noise sensitive receivers (NSRs) with predicted exceedance in air-borne construction noise and the 2 NSRs with predicted exceedance in ground-borne construction noise in the approved EIA Report, the Permit Holder shall, at least one month before commencement of construction of the project, submit to the Director for approval four hard copies and one electronic copy of a construction noise mitigation measures plan”*
- 1.5 Meinhardt Infrastructure and Environment Ltd. (MIEL) has been commissioned by LJHJV to assist in the preparation of the above mentioned Noise Mitigation Measures Plan (NMMP) for SIL(E) Contract 904 (C904).
- 1.6 12 NSRs were identified in the EIA as having residual noise impacts. The 12 NSR's are covered by the SIL(E) EIA construction airborne noise assessment and required to be included in the NMMP by the Environmental Permit (EP). Six of the NSR's are relevant to C904, namely Yen Ching Building (YCB) located at Main Street, Ap Lei Chau next to Entrance A of Lei Tung Station (LET Station), Mei Cheung Court (Block 20) (SOH 5), Mei Ka Court (Block 23A) (SOH 6), Cambridge Court (Block 33A) (SOH 7), Dover Court (Block 25) (SOH 8) and the Precious Blood Primary School (PBPS), the latter five all being located in South Horizons. The EP also specified 2 NSRs which would suffer from construction ground-borne noise to be included in this NMMP, namely Yue On Court -Shan On House (Block F) (YOC 4) and St Peter's Catholic Primary School (SPC).
- 1.7 This NMMP will assess only the NSRs affected by works being undertaken at the Entrance A of Lei Tung Station (NSR YCB) and the NSRs affected by residual ground-borne noise impacts (NSRs YOC4 and SPC). The assessment of the other 5 NSRs at South Horizons will be reported under separate cover.
- 1.8 The EIA predicted that NSR YCB would suffer from construction airborne noise

impacts up to a maximum of 79dB(A), with residual impacts of up to 4dB(A). The NSR YOC4 is located next to the SIL drill and blast tunnel and the EIA predicted that this NSR would suffer from construction ground-borne noise impacts up to a maximum of 73dB(A). Based upon the ground-borne noise criteria for residential NSRs of 65dB(A), residual impacts are, therefore, up to 8dB(A). NSR SPC is also located above the SIL drill and blast tunnel. The EIA predicted that this NSR would suffer from construction ground-borne noise impacts up to a maximum of 61dB(A) with residual impacts, therefore, equating to 1dB(A) as the ground-borne noise criteria for institutional NSRs is 60dB(A). The locations of the NSRs and SIL(E) alignment under this NMMP are shown in **Figure 1.1**.

1.9 This NMMP, presenting the airborne noise assessments made for YCB and ground-borne Noise assessment for YOC4 and SPC, has been prepared to comply with Condition 2.9 of the SIL(E) EP and includes the following information as required by the EP:

- a schedule of construction works to be carried out at the works areas of the Project within 300m from the NSRs YCB, YOC4 and SPC;
- an updated construction methodology of the proposed construction works;
- an updated powered mechanical equipment (PME) list for the proposed construction works;
- an updated proposal of air-borne noise mitigation measures for NSR YCB , including the provision of noise barriers and enclosures; and
- an updated proposal of ground-borne noise mitigation measures for NSR YOC4 and SPC; and
- an updated prediction of noise levels in accordance with the above updated information and mitigation proposals in place.

## 2 Description of the Construction Works in the Study Area

2.1 The 300m study area of YCB is shown in **Figure 1.1**. The ground-borne noise assessment for YOC4 and SPC has been assessed only at the closest distance between the NSR and the drill and blast tunnel, therefore, a 300m study area is not required. The main construction works proposed to be carried out in these areas will comprise the construction of drill and blast tunnel, together with the LET Station, the latter involving rock slope excavation and respective concreting works.

### Ground-borne Noise

2.2 Construction activities for the tunnelling works which could result in ground-borne noise will involve drilling probe holes into the rock and carrying out pre-excavation grouting or support as necessary before initiating blasts and mucking out the excavation. Large rocks are proposed to be broken up into smaller pieces by breakers. The Powered Mechanical Equipment (PME) for the Drill and Blast works as detailed in the SIL(E) EIA report are provided in **Table 2.1** below. The respective vibration level is also included.

**Table 2.1 Vibration Source Levels for PME for the Construction Works**

PME	Vibration (RMS) at Reference Distance of 5.5m from source (Extracted from SIL(E) EIA)
Each Drilling Rig	0.536 mm/s
Hydraulic Breaker	0.298 mm/s

2.3 After review of the construction activities by LJHJV for the drill and blast tunnel, it was concluded that the proposed drilling rig for drilling works would comprise a 3 boom jumbo rig, i.e. a single tractor unit with 3 arms, each of which has a drill attached. Therefore, a 3 drilling rigs instead of 1 has been assessed. However, for assessment purposes the same vibration source would be used.

### Air-borne Noise

#### **Construction Methodology**

2.4 In respect of the airborne noise assessment, the SIL(E) EIA reported both unmitigated and mitigated versions of Plant Inventories for the construction of SIL(E). Within 300m study area from the NSR YCB, the construction works included the construction of LET Station Entrance A, LET Station Entrance B and a portion of cut and cover works, including tunnel box excavation at Ap Lei Chau.

2.5 The approved plant inventory in the SIL(E) EIA has been reviewed and revised in accordance to the updated construction design and sequence prepared by LJHJV, and, therefore, new construction plant inventories are proposed for LET Station Entrance A and a breakdown of the major construction activities in sequence to be carried out within 300m of the NSR YCB is shown below and detailed in **Appendix A**.

- Activity 1 - soil nailing and slope work behind Entrance A;
- Activity 2 - Site formation, Pipe piles, Excavation including rock excavation, Excavation and Lateral Support, Piling, Grouting; and
- Activity 3 - Construction of Building structure.

2.6 Construction noise impacts are generally generated by the excavation for station entrance, where piling, excavation and rock breaking are involved.

2.7 The construction methodology and plant for LET Station Entrance B and the cut and cover works at Ap Lei Chau have been assumed to be the same as detailed in the SIL(E) EIA.

***Revised Construction Schedule***

2.8 The detailed construction scheduling prepared by LJHJV has been used in this NMMP and has been presented on a week by week basis for the duration of the construction works in the Study Area. The construction schedule has been adjusted such that construction works are not carried out concurrently at the same location as far as possible. The revised construction schedule is shown in the detailed calculations presented in **Appendix B**.

***Updated Powered Mechanical Equipment (PME) List***

2.9 The updated Powered Mechanical Equipment (PME) list for the construction works is provided in **Table 2.2** below. The Sound Power Levels (SWL) for the PMEs have been adopted from BS 5228-1:2009 or EPD's Technical Memorandum on Noise from Construction Work other than Percussive Piling. In addition, the LJHJV has also confirmed the availability of the listed PMEs in Hong Kong. The PME as relevant to individual construction activities are provided in **Appendix A**.

**Table 2.2 PME List for the Construction Works**

PME	TM or BS Reference	Sound Power Level, dB(A)
Tracked mobile crane (132kW, 55t)	BS C3/29	98
Poker vibratory	BS C4/34	97
Consolidated rig (down-the-hole hammer) (160kW)	BS D11/2	112
Tracked Excavator	BS D3/35	106
Concrete pump	BS D6/36	106
Wheeled Excavator/Loader fitted with Hydraulic Rock Breaker	BS D8/12	106
Dump Truck	BS D9/39	103
Air compressor, air flow >10m <sup>3</sup> /min and ≤30m <sup>3</sup> /min	CNP 002	102
Breaker, hand-held, mass ≤10kg	CNP 023	108
Drill, percussive, hand-held (electric)	CNP 064	103

<b>PME</b>	<b>TM or BS Reference</b>	<b>Sound Power Level, dB(A)</b>
Generator, super silenced, 70dB(A) at 7m	CNP 103	95
Grout mixer	CNP 105	90
Grout pump	CNP 106	105
Saw, circular, wood	CNP 201	108
Winch (electric)	CNP 262	95
Water pump, submersible (electric)	CNP 283	85
Rock Drill †	Ref TNS EIA	108
Truck Mixer	BS D6/35	100

† the PME was referenced to the approved Tsim Sha Tsui Northern Subway EIA Report

### 3 Noise Assessment and Proposed Mitigation Measures

#### Ground-borne Noise Assessment

##### *Methodology and Assumptions*

- 3.1 The construction ground-borne noise assessment has been carried out in accordance to the methodology used in the approved SIL(E) EIA. The nearest distances and other assumptions have been adopted directly from the SIL(E) EIA.
- 3.2 After comparing the attenuation adopted in SIL(E) EIA, it was observed that a uniform 6dB(A) attenuation for all frequency as Building Vibration Response (BVR) had been assigned for the SIL(E). However, according to Figure 5 presented in Appendix 4.2 of the approved West Island Line (WIL) EIA Report, varied attenuations of between 2-6 dB(A) had been applied. As such, it is considered that the BVR attenuation in the SIL(E) EIA could be conservative and it would be appropriate to adopt the BVR values in the WIL EIA, as detailed in **Table 3.1** below. The BVR graph from the WIL EIA is reproduced as **Figure 3.1**.

**Table 3.1 Building Vibration Response (BVR) adopted in WIL EIA**

Octave Band Frequency (Hz)	16	32	63	125	250	500
Attenuation, dB(A)	4	6	6	5	2	0

##### *Results and Proposed Mitigation Strategy*

- 3.3 Since the proposed drilling rig for drilling works comprises a 3 boom jumbo, 3 drilling rigs instead of 1 have been assessed. The calculated assessment results are presented in **Appendix C** and summarised in **Table 3.2** below. It should be noted that the hydraulic breaker and drill rig will not be operated concurrently in close proximity.
- 3.4 As shown in **Table 3.2**, the maximum construction ground-borne noise impacts at YOC4 and SPC induced by the tunnel drilling rigs should be 72dB(A) and 60dB(A) respectively. Therefore, based upon the revised assessment methodology, a 7dB(A) residual impact (reduced from an 8dB(A) residual impact reported in the SIL(E) EIA) is predicted at YOC4 and no exceedances are predicted at SPC (reduced from a 1dB(A) exceedance in the SIL(E) EIA).

**Table 3.2 Updated Cumulative Construction Ground-borne Noise Impact at Respective NSRs**

NSR	Ground-borne Noise Impact from PMEs, dB(A)	
	Hydraulic Breaker	Drill Rigs
YOC 4	62	72 Residual Impact: 7dB(A)
SPC	50	60

The ground-borne noise criteria for YOC 4 and SPC are 65dB(A) (residential) and 60dB(A) (institutional) respectively.

- 3.5 As noted above, YOC4 is predicted to still be exposed to a residual impact of 7dB(A). A reverse calculation demonstrates that if the separation distance between the PME and the NSR was increased to 26m, there would be no exceedances. Therefore, a slant distance of 26m can be considered as being the ground-borne noise “Zone of Potential Influence” for this NSR and within which the NSR may experience ground-borne noise impacts. **Figure 1.1** shows the extent of the area, with 26m being adopted as the horizontal distance as a conservative approach. It has been estimated that the period of time that tunnel construction works would be undertaken within this zone and, therefore, have the potential to result in ground-borne noise impacts is comparable to the exceedance duration detailed in the SIL(E) EIA of 3 weeks.
- 3.6 Notwithstanding the short duration, it is considered that administrative arrangements could help to reduce the effects of the ground-borne noise impacts. Tunnel drilling works may be conducted within the YOC4 “Zone of Potential Influence” during an agreed timeframe when the ground-borne noise impact would have less impacts on people occupying the building.
- 3.7 The revised assessment anticipated that the NSR SPC would not be affected by the drill and blast works. However, it is proposed that close communication will be maintained with the school to avoid impacts, particularly during exam periods.
- 3.8 The need for contingency provisions for possible Restricted Hours working under the Noise Control Ordinance will be considered. Dialogue with relevant authorities will need to start at an early stage to finalise our strategy and to assess the likelihood of Construction Noise Permits being issued for critical works. In accordance with the contract approval from the engineer will be required before any applications for a construction noise permit are made. During the construction stage, when restricted hours working are required and permitted, a secondary permit-to-work system will be implemented to ensure full compliance with Construction Noise Permit conditions to minimise impacts to the public and nearby premises.

### **Airborne Noise Assessment**

#### ***Methodology and Assumptions***

- 3.9 The construction noise assessment has been carried out in accordance to the methodology used in the approved SIL(E) EIA. Notional source distances have been measured and revised for the construction of LET Station.
- 3.10 The percentage on-time for each PME has been estimated individually for each construction activity to ensure practicality and reference has been made to the assumptions used in the SIL(E) EIA.
- 3.11 All proposed mitigation measures in this NMMP and their effectiveness have been previously adopted in the SIL(E) EIA and silent plant, noise barriers, including movable barriers and enclosure/sheds, and acoustic fabric have been considered, as detailed in **Table 3.3** below. Due to site constraints, noise barriers have been evaluated for each PME and applied where feasible.

**Table 3.3 Mitigation Measures Adopted for the PME's within the Study Area**

PME	Type of Noise Barrier	Noise Level Reduction, dB(A)
Air compressor, air flow >10m <sup>3</sup> /min and ≤30m <sup>3</sup> /min	Noise Enclosure	-15
Generator, super silenced, 70dB(A) at 7m	Noise Enclosure	-15
Consolidated rig (down-the-hole hammer) (160kW)	Acoustic Fabric	-10
Drill, percussive, hand-held (electric)	Movable Noise Barrier	-10
Grout pump	Movable Noise Barrier	-10
Saw, circular, wood	Movable Noise Barrier	-10
Water pump, submersible (electric)	Movable Noise Barrier	-10
Rock Drill	Acoustic Fabric	-10
Tracked mobile crane (132kW, 55t)	Movable Noise Barrier	-5
Tracked Excavator	Movable Noise Barrier	-5
Concrete pump	Movable Noise Barrier	-5
Wheeled Excavator/Loader fitted with Hydraulic Rock Breaker	Movable Noise Barrier	-5
Breaker, hand-held, mass ≤10kg	Movable Noise Barrier	-5
Grout mixer	Movable Noise Barrier	-5
Winch (electric)	Movable Noise Barrier	-5

**Results and Proposed Mitigation Strategy**

3.12 The cumulative impacts for all construction activities have been assessed, and the calculated assessment results are presented in **Appendix B** and summarised in **Table 3.4** below. The proposed mitigation measures described above are included in the assessment and, as such, only the mitigated scenario has been presented.

3.13 For the cut and cover works at Ap Lei Chau, the contribution to the cumulative airborne noise impact at YCB is considered to be insignificant. Based upon the details provided in the SIL(E) EIA assessment (Appendix 3.3g of the SIL(E) EIA), the worst construction activities would be Activity 6 - Construction of Box Tunnel and Backfill with an Sound Power Level (SWL) of 113dB(A). It should be noted that although there are other activities for the Ap Lei Chau cut and cover works, for example Activity 7, which have higher sound power levels, these are located more than 300m away from the NSR and therefore not considered. Taking into account the distance attenuation of about 300m and an associated attenuation equalling 57.5dB(A), these Ap Lei Chau construction works would impose a Sound Pressure Level (SPL) of 58dB(A) as a worst case, without considering any additional shielding effects by other buildings. Based upon an SPL at YCB from the LET Entrance A works of 78dB(A), the contribution from the Ap Lei Chau works would not affect the cumulative impacts. Therefore, these cut and cover works have not been included in the cumulative impact

assessment of YCB.

- 3.14 For the construction of LET Station Entrance B, the contribution to the cumulative airborne noise impact at YCB would also be considered as insignificant. Based upon the details provided in the SIL(E) EIA assessment (Appendix 3.3h2 of the SIL(E) EIA), the worst construction activities would be Activity 1 - Entrance B Piling/Walling or Activity 3 - Entrance B Concrete Works, both with a Sound Power Level (SWL) of 108dB(A). Taking into account the distance attenuation of about 300m from the NSR and an associated attenuation equalling 57.5dB(A), these construction works at LET Station Entrance B would impose a Sound Pressure Level (SPL) of 53dB(A) as a worst case, without considering any additional shielding effects by other buildings. Based upon an attenuated noise level at YCB from the LET Entrance A works of 78dB(A), the contribution from the LET Station Entrance B works would not affect the cumulative impacts. Therefore, these construction works have not been included in the cumulative impact assessment of YCB.
- 3.15 At LET Station Entrance A, as shown in **Table 3.4** below, by the implementation of quiet plant, noise barriers, enclosures/sheds and acoustic fabric for the PMEs and rescheduling the construction works as far as possible to avoid cumulative impacts, the maximum construction noise impact at YCB can be reduced by about 1dB(A) to 78dB(A), with the exceedance period at this noise level also being reduced to 1.25 months. The remaining exceedances of 1dB(A) are anticipated to last for 7 months only. These values are reduced compared to the predicted values in the SIL(E) EIA which reports the residual impacts of 4dB(A) for 5.5 months and 2dB(A) for 6 months.

**Table 3.4 Updated Mitigated Construction Noise Impact at Respective NSRs**

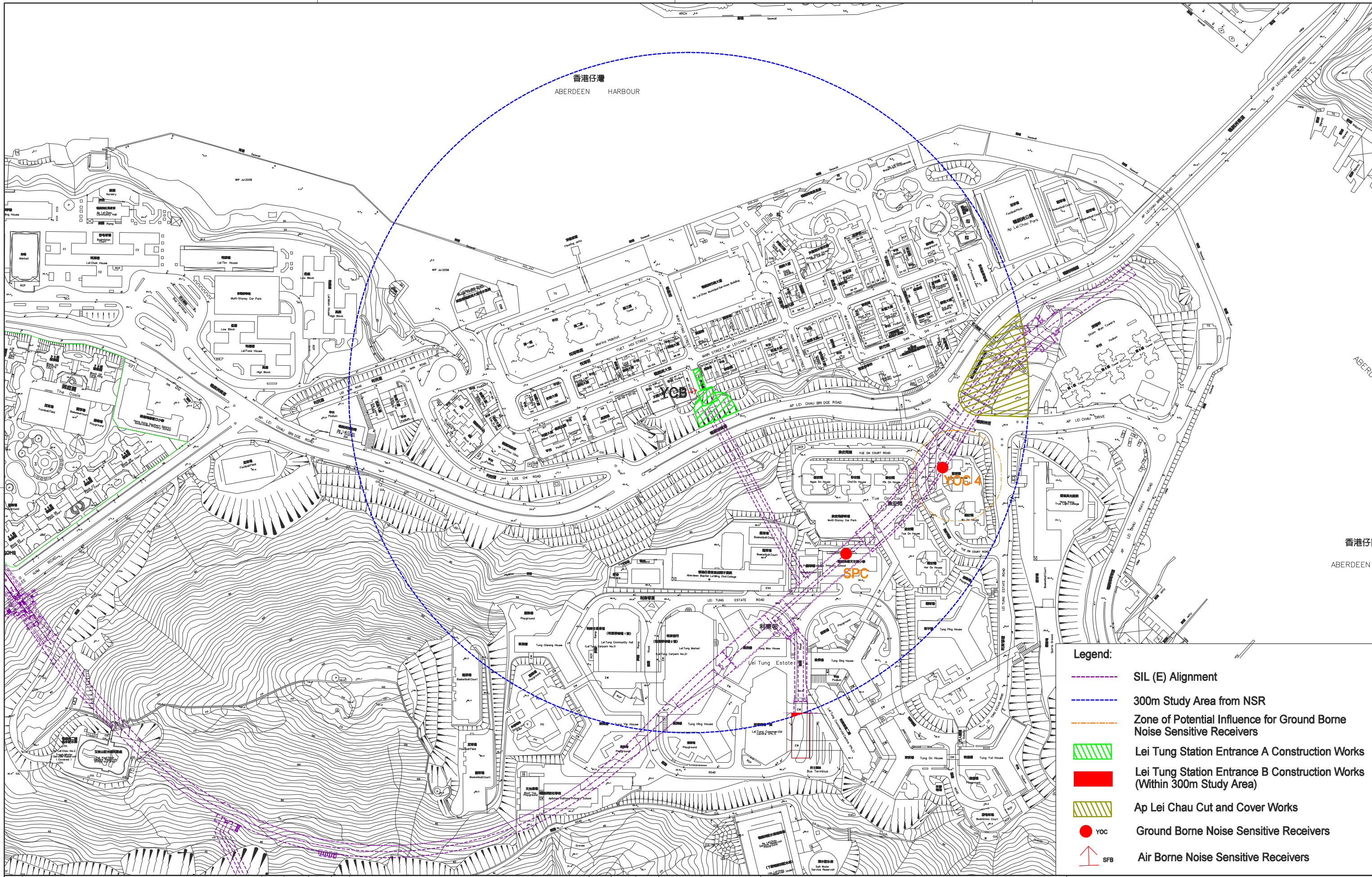
PME	Maximum Noise Impact from SIL(E), dB(A)					
	Revised Scenario			EIA Assessed Scenario		
	Max Noise Level	Exceedance and Duration		Max Noise Level	Exceedance and Duration	
YCB	78	1-4dB(A)	≥5dB(A)	79	1-4dB(A)	≥5dB(A)
		8.25 months	(0 month)		11.5 months	(0 month)

- 3.16 Between LET Ent A and YCB, a new hotel has been built as confirmed by a recent site visit, as shown in Figure 3.2. This new building is tall enough to screen the construction site from the YCB and would act as noise barrier and offer at least 5dB(A) attenuation for the construction noise impacts at YCB. The 3dB(A) exceedance would, therefore, be mitigated and, thus, no residual impacts at YCB would be anticipated.
- 3.17 The new hotel development will be provided with central air conditioning and will not rely on opened windows for ventilation. In accordance with the guideline provided in the EIAO Technical Memorandum, further construction noise assessment at the hotel is not required.

## 4 Conclusion

- 4.1 With the implementation of the proposed noise mitigation measures, construction noise impacts are now predicted to be reduced in respect of both exceedances and duration. However, the newly built hotel development will provide a screening effect and, thus, the NSR YCB is anticipated to have no residual impact.
- 4.2 Further review and update will be performed during the construction phase and liaison with affected parties is essential to minimise the construction noise impacts as far as possible.

**Figure 1.1**      **Locations of NSRs and Alignment Scheme**



- Legend:**
- SIL (E) Alignment
  - 300m Study Area from NSR
  - Zone of Potential Influence for Ground Borne Noise Sensitive Receivers
  - ▨ Lei Tung Station Entrance A Construction Works
  - ▨ Lei Tung Station Entrance B Construction Works (Within 300m Study Area)
  - ▨ Ap Lei Chau Cut and Cover Works
  - yoc Ground Borne Noise Sensitive Receivers
  - ▲ sfb Air Borne Noise Sensitive Receivers

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN  
DESIGNED  
CHECKED  
APPROVED  
DATE

**MTR**

**SOUTH ISLAND LINE (EAST)**

ORIGINATOR

**LEIGHTON** 禮頓  
**Leighton - John Holland Joint Venture**

**John Holland**

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CADD REF. Fig 1.1.dgn

TITLE

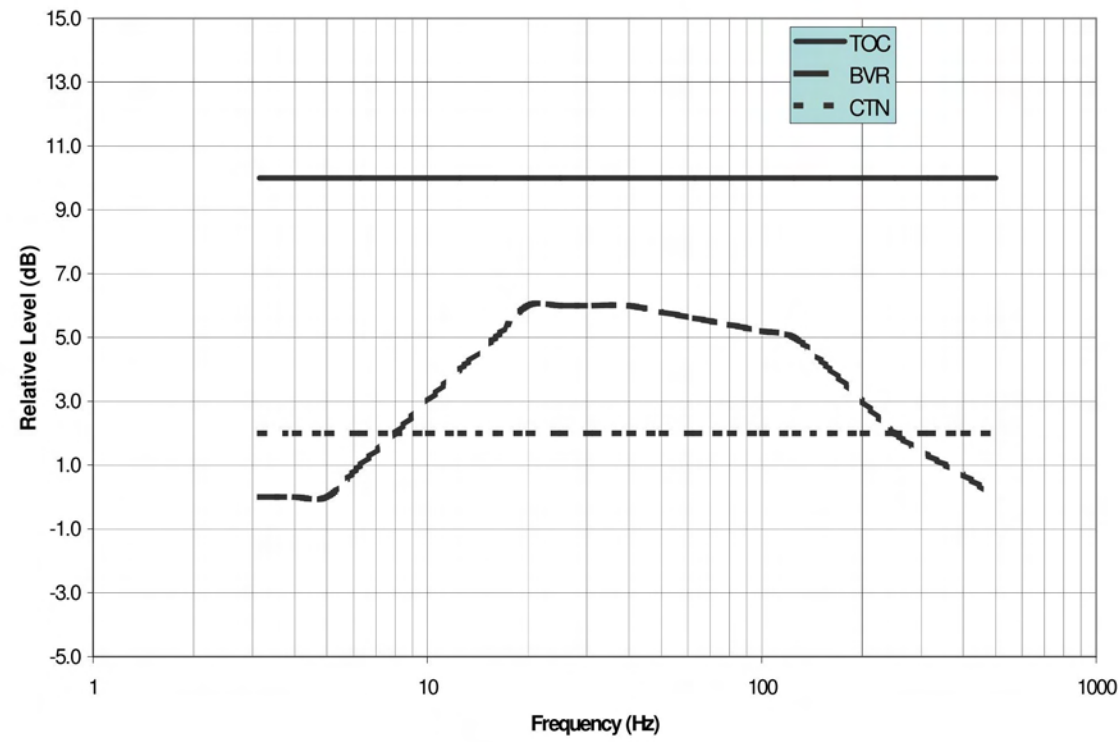
**CONTRACT 904**  
**LOCATION OF NSRS AND ALIGNMENT SCHEME**

SCALE @ A1

DRAWING NO. FIGURE 1.1

REV. --

**Figure 3.1** Building Vibration Response Graph adopted from WIL EIA Report



**FIGURE 5 MISCELLANEOUS CORRECTION FACTORS USED IN THE PROJECTION OF GROUND BORNE VIBRATION ON THE WIL**

				DRAWN				 <b>SOUTH ISLAND LINE (EAST)</b> ORIGINATOR 				TITLE			
				DESIGNED								CONTRACT 904			
				CHECKED								BUILDING VIBRATION RESPONSE GRAPH			
				APPROVED								ADOPTED FROM THE WIL EIA REPORT			
				DATE				SCALE @ A1							
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TENDER SUBMISSION				CADD REF. MTR-904-A1.dgn				FIGURE 3.1							
REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED	

**Figure 3.2**      **Photograph of the New Hotel Development**



				DRAWN				MTR				TITLE			
				DESIGNED				SOUTH ISLAND LINE (EAST)				CONTRACT 904			
				CHECKED				ORIGINATOR				PHOTOGRAPH OF THE NEW HOTEL DEVELOPMENT			
				APPROVED											
				DATE				CADD REF. Fig 3.2_Frame.dgn				SCALE @ A1			
				DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.								DRAWING NO. FIGURE 3.2			
				© LEIGHTON-JOHN HOLLAND JV COPYRIGHT IN RESPECT OF THIS DRAWING / DOCUMENT IS OWNED BY THE LEIGHTON-JOHN HOLLAND JV OF HONG KONG. NO REPRODUCTION OF THE DRAWING / DOCUMENT OR ANY PART BY WHATEVER MEANS IS PERMITTED WITHOUT THE PRIOR WRITTEN CONSENT OF THE LEIGHTON-JOHN HOLLAND JV.								REV. --			
REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED	TENDER SUBMISSION					

## Appendix A Construction Activities and Plant Inventory

Appendix A  
Construction Activities and Plant Inventory for LET Station Works Site  
Mitigated Scenario

LET Station Entrance A

Group	PME	TM or other ref.	No. of PME	SWL dB(A)/unit	Screening Effect dB(A)	Noise Mitigation Measure	% on time	Total SWL dB(A)
<b>Activity 1 - soil nail and slope work behind Entrance A</b>								
<b>(Group 1 - Soil Nail Installation)</b>								
	Rock Drill †	Ref TNS EIA	2	108	-10	Acoustic Fabric	80%	100
	Air compressor, air flow > 10m <sup>3</sup> /min and <= 30m <sup>3</sup> /min	CNP 002	2	102	-15	Noise Enclosure	100%	90
<b>Total</b>								100
<b>(Group 2 - Grouting)</b>								
	Grout mixer	CNP 105	1	90	-5	Movable Noise Barrier	50%	82
	Grout pump	CNP 106	1	105	-10	Movable Noise Barrier	50%	92
<b>Total</b>								92
<b>(Group 3 - Excavation)</b>								
	Tracked Hydraulic excavator	BS C10/2	2	104	-5	Movable Noise Barrier	35%	97
	Dump Truck	BS D9/39	1	103			50%	100
<b>Total</b>								102
<b>Activity 2a - Site formation, Pipe piles, Excavation including rock excavation, Excavation and Lateral Support - Piling</b>								
	Air compressor, air flow > 10m <sup>3</sup> /min and <= 30m <sup>3</sup> /min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	70%	91
	Consolidated rig (down-the-hole hammer) (160kW)	BS D11/2	2	112	-10	Acoustic Fabric	80%	104
	Tracked Hydraulic excavator	BS C10/2	2	104	-5	Movable Noise Barrier	50%	99
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80
	Water pump, submersible (electric)	CNP 283	1	85	-10	Movable Noise Barrier	100%	75
<b>Total</b>								106
<b>Activity 2b - Site formation, Pipe piles, Excavation including rock excavation, Excavation and Lateral Support - Piling - Rock Breaking and Soft Excavation</b>								
	Breaker, hand-held, mass <= 10kg	CNP 023	1	108	-5	Movable Noise Barrier	50%	100
	Wheeled Excavator/Loader fitted with Hydraulic Rock Breaker	BS D8/12	1	106	-5	Movable Noise Barrier	70%	99
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90
<b>Total</b>								103
<b>Activity 2c - Site formation, Pipe piles, Excavation including rock excavation, Excavation and Lateral Support - Piling - Grouting</b>								
	Air compressor, air flow > 10m <sup>3</sup> /min and <= 30m <sup>3</sup> /min	CNP 002	1	102	-15	Noise Enclosure	100%	87
	Grout mixer	CNP 105	1	90	-5	Movable Noise Barrier	50%	82
	Grout pump	CNP 106	1	105	-10	Movable Noise Barrier	50%	92
	Water pump, submersible (electric)	CNP 283	1	85	-10	Movable Noise Barrier	100%	75
<b>Total</b>								94
<b>Activity 3a - Construction of Building structure</b>								
	Air compressor, air flow > 10m <sup>3</sup> /min and <= 30m <sup>3</sup> /min	CNP 002	1	102	-15	Noise Enclosure	80%	86
	Poker vibratory	BS C4/34	3	97			50%	99
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	60%	91
	Saw, circular, wood	CNP 201	1	108	-10	Movable Noise Barrier	50%	95
	Winch (electric)	CNP 262	1	95	-5	Movable Noise Barrier	80%	89
	Water pump, submersible (electric)	CNP 283	2	85	-10	Movable Noise Barrier	100%	78
	Drill, percussive, hand-held (electric)	CNP 064	1	103	-10	Movable Noise Barrier	100%	93
<b>Total</b>								102
<b>Activity 3b - Construction of Building structure (Stationary PMEs)</b>								
	Truck Mixer (5m <sup>3</sup> )	BS D6/35	1	100	-5	Movable Noise Barrier	50%	92
	Concrete pump (100kW)	BS D6/36	1	106	-5	Movable Noise Barrier	50%	98
<b>Total</b>								99

**Appendix B Construction Schedule with Air-borne Noise Assessment  
(Mitigation Scenario)**





## Appendix C Construction Ground-borne Noise Assessment

**Appendix C**  
**Construction Ground-borne Noise Assessment**  
**Unmitigated Scenario**

NSR No. YOC  
 Name Yue On Court - Shan On House (Block F)

**PME Excavator Mounted Breaker**

Item	Description	16	32	63	125	250	500	Hz	Assumption
	Octave Band Frequency								
	rms Velocity	0.059	0.068	0.062	0.050	0.062	0.121	mm/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
	rms Velocity	0.002	0.003	0.002	0.002	0.002	0.005	in/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
1	Vibration Velocity, ref 10 <sup>-6</sup> mm/s	67	69	68	66	68	74	dB(V)	20 x log (V*1,000,000)
2	Ro	5.5	5.5	5.5	5.5	5.5	5.5	m	Site Measurement of breaker operation at distance = 5.5m Shortest Distance from the site to the NSR -20 x log (R/Ro)
	R	12	12	12	12	12	12	m	
	Distance Attenuation	-7	-7	-7	-7	-7	-7	dB	
3	Soil / Rock Damping	0.0	0.0	0.0	0.0	0.0	0.0	dB	Vibration will be transmitted from the rock breaking to the pile of the building. The whole transmission path is assumed to be rock
4	Building Coupling Loss	0	0	0	0	0	0	dB	Transportation Noise Reference Book, EIA Report Section 4.40, no attenuation for Building Foundation on Rock Layer
5	Floor to Floor Attenuation	-2	-2	-2	-2	-2	-2	dB	-2dB(A) for each floor above ground floor, EIA Report Main Text
6	Building Vibration Response	4	6	6	5	2	0	dB	Figure 5, Appendix 4.2, WIL EIA Report
7	Conversion to A-Weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principle
	Individual Groundborne Noise	6	26	38	46	52	61	dB(A)	Standard acoustic principle
	Predicted Groundborne Noise for Hydraulic Breaker Operation							62 dB(A)	

**PME Drill Rig**

Using the calculated Hydraulic breaker noise to correct to Rock Drill Noise	5.1	dB(A)	20log(0.536/0.298) Site Measurement in KSL EIA Appendix 7.1
Correction for Cumulative Groundborne Noise for Multiple PME (3 drilling head)	4.8	dB(A)	+10 x log <sub>10</sub> (3)
Predicted Groundborne Noise for drill rig operation	72	dB(A)	

**Appendix C**  
**Construction Ground-borne Noise Assessment**  
**Unmitigated Scenario**

NSR No. SPC  
Name St. Peter's Catholic Primary School

**PME Excavator Mounted Breaker**

Item	Description	16	32	63	125	250	500	Hz	Assumption
	Octave Band Frequency								
	rms Velocity	0.059	0.068	0.062	0.050	0.062	0.121	mm/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
	rms Velocity	0.002	0.003	0.002	0.002	0.002	0.005	in/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
1	Vibration Velocity, ref 10-6 mm/s	67	69	68	66	68	74	dB(V)	$20 \times \log (V^*1,000,000)$
2	Ro R Distance Attenuation	5.5 48 -19	5.5 48 -19	5.5 48 -19	5.5 48 -19	5.5 48 -19	5.5 48 -19	m m dB	Site Measurement of breaker operation at distance = 5.5m Shortest Distance from the site to the NSR $-20 \times \log (R/Ro)$
3	Soil / Rock Damping	0.0	0.0	0.0	0.0	0.0	0.0	dB	Vibration will be transmitted from the rock breaking to the pile of the building. The whole transmission path is assumed to be rock
4	Building Coupling Loss	0	0	0	0	0	0	dB	Transportation Noise Reference Book, EIA Report Section 4.40 no attenuation for Building Foundation on Rock Layer
5	Floor to Floor Attenuation	-2	-2	-2	-2	-2	-2	dB	-2dB(A) for each floor above ground floor, EIA Report Main Text
6	Building Vibration Response	4	6	6	5	2	0	dB	Figure 5, Appendix 4.2, WIL EIA Report
7	Conversion to A-Weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principle
	Individual Groundborne Noise	-6	14	26	34	40	50	dB(A)	Standard acoustic principle
	Predicted Groundborne Noise for Hydraulic Breaker Operation							50 dB(A)	

**PME Drill Rig**

Using the calculated Hydraulic breaker noise to correct to Rock Drill Noise	5.1	dB(A)	$20\log(0.536/0.298)$ Site Measurement in KSL EIA Appendix 7.1
Correction for Cumulative Groundborne Noise for Multiple PME (3 drilling head)	4.8	dB(A)	$+10 \times \log_{10} (3)$
Predicted Groundborne Noise for drill rig operation	60	dB(A)	

Annex D

CNMMP for Contract No.  
904 (South Horizons Station  
and Tunnels)



## Noise Mitigation Measures Plan for SOUTH HORIZONS STATION MTR South Island Line Contract 904

### Revision History and Plan Approval

Revision	Date	Prepared by:	Reviewed by	Approved by:	Section/Description
06	18 Jan 2012	Chris Chan	David Holden	Wes Jones	Response to EPD's comment
05	26 Nov 2011	Chris Chan	David Holden	Wes Jones	Response to EPD's comment
04	30 Sept 2011	Chris Chan	David Holden	Wes Jones	Response to EPD and MTR's comment
03	02 Aug 2011	Stephen Tsang	David Holden	Wes Jones	Fourth Issue
02	28 July 2011	Stephen Tsang	David Holden	Ken Henderson	Third Issue
01	23 July 2011	Stephen Tsang	David Holden	Ken Henderson	Second Issue
00	06 July 2011	Stephen Tsang	David Holden	Ken Henderson	First Issue

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## Appendices

Appendix A	Construction Activities and Plant Inventory
Appendix B	Ground Investigation Record for South Island Line
Appendix C	Construction Schedule with Air-borne Noise Assessment (Mitigated Scenario)

## 1. Introduction

- 1.1 In December 2007, the Government gave the approval for the MTR Corporation Limited (MTRCL) to proceed with preliminary planning and design of the South Island Line eastern section (SIL(E)). The SIL(E) (The Project) will be a medium capacity railway that measures a total length of approximately 7 km. It will run from Admiralty to South Horizons, with three intermediate stations at Ocean Park, Wong Chuk Hang and Lei Tung.
- 1.2 The construction of the South Island Line has been divided into a series of Contracts and Contract 904, covering the section of the South Island Line (East) from Aberdeen Channel Bridge to the South Horizon Station and including stations at Lei Tung, respective plant buildings and barging points was awarded to Leighton – John Holland Joint Venture (LJHJV) in May 2011.
- 1.3 The South Island Line (East) Environmental Impact Assessment (SIL(E) EIA) Report for the Project was submitted and subsequently approved with conditions by the Environmental Protection Department (EPD) on 26 Oct 2010.
- 1.4 Condition 2.9 of the approved Environmental Permit (EP-407/2010) stated that: *“To further reduce the construction noise impacts on the 12 noise sensitive receivers (NSRs) with predicted exceedance in air-borne construction noise and the 2 NSRs with predicted exceedance in ground-borne construction noise in the approved EIA Report, the Permit Holder shall, at least one month before commencement of construction of the project, submit to the Director for approval four hard copies and one electronic copy of a construction noise mitigation measures plan”*
- 1.5 Meinhardt Infrastructure and Environment Ltd. (MIEL) has been commissioned by LJHJV to assist in the preparation of the above mentioned Noise Mitigation Measures Plan (NMMP) for SIL(E) Contract 904 (C904 - South Horizons Station).
- 1.6 A total of 12 NSRs were identified in the approved EIA as having residual noise impacts. The 12 NSR's are covered by the SIL(E) EIA construction airborne noise assessment and required to be included in the NMMP by the Environmental Permit (EP). Six of the NSR's are relevant to C904, namely Yen Ching Building (YCB) located at Main Street, Ap Lei Chau next to Entrance A of Lei Tung Station (LET Station), Mei Cheung Court (Block 20) (SOH 5), Mei Ka Court (Block 23A) (SOH 6), Cambridge Court (Block 33A) (SOH 7), Dover Court (Block 25) (SOH 8) and the Precious Blood Primary School (PBPS), the latter five all being located in South Horizons. The EP also specified 2 NSRs which would suffer from construction ground-borne noise to be included in the NMMP, namely Yue On Court -Shan On House (Block F) (YOC 4) and St Peter's Catholic Primary School (SPC).
- 1.7 It should be noted that the NSR PBPS is located to the north of the SOH Station and close to the proposed Essential Public Infrastructure Works (EPIW) for a footbridge across South Horizon Drive near Yi Nam Road junction, as shown in **Figure 3.1**. While the EPIW footbridge is not part of the SIL(E) project and EIA, it is a potential cumulative activity to be considered.

- 1.8 This NMMP is proposed to assess only the NSRs affected by works being undertaken at the South Horizons Station (NSRs SOH 5 to SOH 8 and PBPS) and any cumulative activities. The locations of the NSRs under this NMMP are shown in **Figure 1.1**. The assessment of the other NSRs at Lei Tung Station and for the ground-borne noise impacts at Yue On Court - Shan On House (Block F) and St Peter's Catholic Primary School has been reported under separate cover.
- 1.9 The EIA predicted the following construction airborne noise impacts at each of the 5 NSRs at SOH:
- NSR SOH 5 - up to a maximum of 82dB(A), with residual impacts of up to 7dB(A);
  - NSR SOH 6 - up to a maximum of 81dB(A), with residual impacts of up to 6dB(A).
  - NSR SOH 7 - up to a maximum of 76dB(A), with residual impacts of up to 1dB(A);
  - NSR SOH 8 - up to a maximum of 78dB(A), with residual impacts of up to 3dB(A);
  - NSR PBPS - up to a maximum of 74dB(A), with residual impacts of up to 4dB(A).
- 1.10 This NMMP is prepared to comply with Condition 2.9 of the SIL(E) EP and presents the following information as required by the EP:
- a schedule of construction works to be carried out at the works areas of the Project within 300m from the NSRs SOH 5, SOH 6, SOH 7, SOH 8 and PBPS;
  - an updated construction methodology of the proposed construction works;
  - an updated powered mechanical equipment (PME) list for the proposed construction works;
  - an updated proposal of air-borne noise mitigation measures for the 5 NSRs as shown in **Figure 1.1** including the provision of noise barriers and enclosures; and
  - an updated prediction of noise levels in accordance with the above updated information and mitigation proposals in place.

## 2 Description of the Construction Works in the Study Area

- 2.1 The 300m study areas of NSRs SOH 5 to SOH 8 and PBPS are shown in **Figure 1.1**. The main construction works proposed to be carried out in these areas will comprise the construction of SOH Station and plant building involving piling, excavation at rock slope, mixed ground and rock ground, and respective concreting works for station body and plant building. In addition, construction of the EPIW, a footbridge connecting to Ap Lei Chau Estate, is also located within the Study Area.

### Construction Methodology

- 2.2 In respect of the airborne noise assessment, the SIL(E) EIA reported both the unmitigated and mitigated versions of Plant Inventories for the construction of SIL(E). Within the 300m study area from the NSRs, the construction works include the construction of the SOH Station and the associated plant building.
- 2.3 The approved plant inventory in the SIL(E) EIA has been reviewed and revised in accordance to the updated construction design and sequence prepared by LJHJV, and, therefore, new construction plant inventories are proposed for the SOH station and the associated plant building.
- 2.4 The construction for the SOH station has been divided into a number of Temporary Traffic Management (TTM) Stages to ensure traffic flows during the construction works. A breakdown of the major construction activities proposed by LJHJV, in sequence, to be carried out within 300m of the NSRs are shown below and detailed in **Appendix A**.

### ***Plant Building***

- Activity 1 - Excavate Top Soil;
- Activity 2 - Excavate in Mixed Ground;
- Activity 3 - Rock Excavation at Rock Slope; and
- Activity 4 - Construction of Plant Building.

### ***SOH Station***

#### **TTM Stage 1B**

- Activity 1B.1 - Piling near Plant Building.

#### **TTM Stage 2A**

- Activity 2A.2 - Piling for Station Body;
- Activity 2A.2a - Yi Nam Road Near Lee Nam Road (4 sets in total);
- Activity 2A.2b - Yi Nam Road Near South Horizon Drive (2 sets in total); and
- Activity 2A.3 - Air Compressors for Drill Rigs.

#### **TTM Stage 2B**

- Activity 2B.1 - Piling for Station Body at Cofferdam #1;
- Activity 2B.2 - Station Cut & Cover;
- Activity 2B.2a - Stationary Plant at unloading area;
- Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD;
- Activity 2B.2c - Excavate in Mixed Ground from +6mPD with half deck (Above Decking);

- Activity 2B.2d - Excavate in Mixed Ground from +6mPD with half deck (Below Decking);
- Activity 2B.2e - Excavate in Mixed Ground from +6mPD with half deck (At Decking Opening);
- Activity 2B.2f - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Above Decking;
- Activity 2B.2g - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Below Decking; and
- Activity 2B.2h - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - At Decking Opening.

#### **TTM Stage 2C**

- Activity 2C.1 - Piling for Station Body at Cofferdam 2;
- Activity 2C.2 - Station Cut & Cover Cofferdam 1;
- Activity 2C.2a - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Above Decking;
- Activity 2C.2b - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - At Decking Opening
- Activity 2C.2c - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Below Decking;
- Activity 2C.2d - After Excavation is complete Start Concrete Base and lower Wall - Above Decking;
- Activity 2C.2e - After Excavation is complete Start Concrete Base and lower Wall - At Deck Opening;
- Activity 2C.2f - After Excavation is complete Start Concrete Base and lower Wall - Under Deck; and
- Activity 2C.2g - Complete Traffic Deck over Cofferdam 1.

#### **TTM Stage 3**

- Activity 3.1 - Piling for Station Body;
- Activity 3.2 - Concreting at Cofferdam 1, Below Traffic Deck;
- Activity 3.4 - Station Cut & Cover;
- Activity 3.4a - Stationary Plant at unloading area;
- Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD;
- Activity 3.4c - Excavate in Mixed Ground from +6mPD with half deck (Above Decking);
- Activity 3.4d - Excavate in Mixed Ground from +6mPD with half deck (Below Decking);
- Activity 3.4e - Excavate in Mixed Ground from +6mPD with half deck (At Decking Opening);
- Activity 3.4f - After Excavation is complete Start Concrete Structure Above Decking;
- Activity 3.4g - After Excavation is complete Start Concrete Structure at Deck Opening;
- Activity 3.4h - After Excavation is complete Start Concrete Structure at Under Deck; and
- Activity 3.4i - Reinstate Utilities and Paving.

#### **TTM Stage 4**

- Activity 4.1 - Remove Decking (at 2 locations: TTM3 deck and near Entrance B Deck); and
- Activity 4.2 - Reinstate Utilities and Paving.

#### **TTM Stage 5**

- Activity 5.1 - Remove Decking (near Entrance B Deck); and
  - Activity 5.2 - Reinstate Utilities and Paving.
- 2.5 Excavation and construction works at SOH Station were spread across the excavation area of SOH Station in various TTM Stages. The respective zoning for each of the TTM Stages are presented in **Figures 2.1 to 2.5**.
- 2.6 Construction noise impacts are generally generated by the excavation for the station body and entrance, where piling, excavation in mixed ground and rock breaking could be undertaken.
- 2.7 In respect of the EPIW, since this is not considered as a core project component of SIL(E), the original plant inventory in the approved EIA (Appendix 3.3i of the SIL(E) EIA) has been used in this NMMP for assessment.

### **Alternative Construction Methodology**

- 2.8 Review of the SIL(E) EIA's suggested construction methodologies indicated that the site conditions may result in some of the recommended construction method as being not feasible. Thus, some of the quiet construction methods recommended by the SIL(E) EIA may, therefore, not be available for this project and have been removed from the construction plant inventory. Further details on the constraints to the EIA methods are provided below.

#### ***Road Ripper***

- 2.9 A road ripper is one method that can be applied for breaking up the road surface and this is generally quieter than conventional breaking with a hydraulic breaker. However, ripping is generally used for large unconfined areas of tarmac where the full depth is to be removed. The depth of removal can be difficult to control and the ripper tooth can dig too deep and damage underground utilities if these are present.
- 2.10 During the site investigation, significant numbers of underground utilities were found to be located around the South Horizons Station. These comprise drainage pipes, watermains, Towngas supply, LPG supply, PCCW Telecom Cables and more than 20 high voltage cables including 11kV, 132kV and 275kV, all of which will need to be exposed for supporting works or diversions. Due to the various types and the considerably large numbers of underground utilities, using a road ripper for road breaking could result in a higher potential for utility damage.
- 2.11 Moreover, the use of road ripper requires a relatively large works area. Given the site constraints of the works area of South Horizons Station, road works along Lee Nam Road and Yi Nam Road have to be broken down into many sub-sections under many stages of temporary traffic management schemes (TTM Stages). Conventional hydraulic breaker, as compared to road ripper, is considered more feasible for the breaking of the road surface in each of the relatively small and limited works area in South Horizons.
- 2.12 In addition, it should be noted that the ripped block sizes may also need to be reduced by secondary breaking using hydraulic hammers, and therefore use of a road ripper will only

increase the numbers and types of PMEs working on site and, thus, potentially generate additional construction noise instead of reducing it. The use of the road ripper is therefore, considered not feasible given the site conditions and the presence of crossing services and utilities.

### ***Press-in Piling***

- 2.13 Press-in piling generally generates less noise than the conventional piling methods. However, given the hard rock/ boulder conditions, the use of press-in piling is ineffective without pre-drilling.
- 2.14 A drill-log is given in **Appendix B** for reference to show the typical ground profile close to the works area. As verified on site, the ground condition of rock fill and hard rock would make press-in piling impossible without substantial pre-drilling. At least 2500mm rock socket length has to be maintained by certain piles. All the ground conditions and the requirement of rock socket length conclude the method of press-in piling impossible near the South Horizons Station.
- 2.15 As such, using the press-in piling method would actually increase the procedures and extend the piling operation, and would, therefore, not be able to mitigate the construction noise impacts as the noise and environmental impact of pre-drilling operation is similar to the construction method proposed in this NMMP.
- 2.16 As a conclusion, the original techniques proposed in the SIL(E) EIA would still require additional supporting equipment which are very similar to that proposed to be used in this NMMP and thus are not included in the revised construction schedule.

### **Revised Construction Schedule**

- 2.17 The detailed construction scheduling prepared by LJHJV has been used in this NMMP and has been presented on a week by week basis for the duration of the construction works in the Study Area. The construction schedule has been adjusted such that construction works are not carried out concurrently at the same location as far as possible. The revised construction schedule is shown in the detailed noise calculations presented in **Appendix C**.

### **Updated Powered Mechanical Equipment (PME) List**

- 2.18 The updated Powered Mechanical Equipment (PME) list for the construction works at SOH Station and associated plant building is provided in **Table 2.1** below. The Sound Power Levels (SWL) for the PMEs has been adopted from BS 5228-1:2009 or EPD's Technical Memorandum on Noise from Construction Work other than Percussive Piling. In addition, the LJHJV has also confirmed the availability of the listed PMEs in Hong Kong. The PME as relevant to individual construction activities are provided in **Appendix A**.

**Table 2.1 Updated PME List for the Construction Works at SOH Station and Plant Building**

PME	TM or BS Reference	Sound Power Level, dB(A)
Tracked Hydraulic excavator	BS C10/2	104
Concrete pump	BS C3/26	103
Tracked mobile crane (132kW, 55t)	BS C3/29	98
Poker vibratory	BS C4/34	97
Concrete lorry mixer	BS D6/33	96
Truck Mixer (5m <sup>3</sup> )	BS D6/35	100
Concrete pump (100kW)	BS D6/36	106
Poker vibrators	BS D6/40	98
Tracked Crane (62kW)	BS D7/114	101
Wheeled excavator/Loader fitted with hydraulic rock breaker	BS D8/12	106
Tracked excavator fitted with hydraulic rock breaker	BS D8/13	110
Asphalt paver	BS D8/24	101
Roller, vibratory	BS D8/30	101
Dump Truck	BS D9/39	103
Air compressor, air flow >10m <sup>3</sup> /min and ≤30m <sup>3</sup> /min	CNP 002	102
Bar bender and cutter (electric)	CNP 021	90
Crane, tower (electric)	CNP 049	95
Drill rig, rotary type (diesel)	CNP 072	110
Generator, super silenced, 70dB(A) at 7 m	CNP 103	95
Lorry, with crane/grab, 5.5 tonne <gross vehicle weight ≤ 38 tonne	CNP 145	105
Saw, circular, wood	CNP 201	108
Ventilation fan	CNP 241	108
Water pump (electric)	CNP 281	88
Water pump, submersible (electric)	CNP 283	85
Rock Drill †	Ref TNS EIA	108

† the PME was referenced to the approved Tsim Sha Tsui Northern Subway EIA Report

2.19 Plant inventories for the cumulative EPIW footbridge works have been extracted from Appendix 3.3i of the SIL(E) EIA.

### 3 Noise Assessment and Proposed Mitigation Measures

#### Methodology and Assumptions

- 3.1 The construction noise assessment has been carried out in accordance to the methodology used in the approved SIL(E) EIA. Notional source distances have been measured and revised for the construction of SOH Station and associated plant building.
- 3.2 The percentage on-time for each PME has been estimated individually for each construction activity to ensure practicality and reference has been made to the assumptions used in the SIL(E) EIA. The PMEs have been assigned to respective works sites. For some works sites, they have been divided into a number of zones and the PMEs assumed to be spread among the zones for calculation, while some PMEs are assumed to be located in the zones closest to the NSRs under assessment for a worst case scenario.
- 3.3 All proposed mitigation measures in this NMMP and their effectiveness have been previously adopted in the SIL(E) EIA and silent plant, noise barriers, including movable barriers and enclosure/sheds, and acoustic fabric have been considered, as detailed in **Table 3.1** below. Due to site constraints, noise barriers have been evaluated for each PME and applied where feasible. For PMEs operating directly beneath traffic decking, a 20dB(A) reduction has been applied to allow for the screening effect. No other mitigation measures have been applied for the PMEs directly underneath the decking. Detailed implementation plan will be shown in **Appendix A**.

**Table 3.1 Mitigation Measures Adopted for the PMEs for SOH Station and Plant Building within the Study Area**

PME	Type of Noise Barrier	Noise Level Reduction, dB(A)
Air compressor, air flow >10m <sup>3</sup> /min and ≤30m <sup>3</sup> /min	Noise Enclosure	-15
Generator, super silenced, 70dB(A) at 7 m	Noise Enclosure	-15
Water pump (electric)	Noise Enclosure	-15
Ventilation fan	Silencer	-15
Drill rig, rotary type (diesel)	Acoustic Fabric	-10
Rock Drill †	Acoustic Fabric	-10
Bar bender and cutter (electric)	Movable Noise Barrier	-10
Saw, circular, wood	Movable Noise Barrier	-10
Water pump, submersible (electric)	Movable Noise Barrier	-10
Tracked Hydraulic excavator	Movable Noise Barrier	-5
Concrete pump	Movable Noise Barrier	-5
Tracked mobile crane (132kW, 55t)	Movable Noise Barrier	-5
Concrete lorry mixer	Movable Noise Barrier	-5
Truck Mixer (5m <sup>3</sup> )	Movable Noise Barrier	-5

PME	Type of Noise Barrier	Noise Level Reduction, dB(A)
Concrete pump (100kW)	Movable Noise Barrier	-5
Tracked excavator fitted with hydraulic rock breaker	Movable Noise Barrier	-5
Lorry, with crane/grab, 5.5 tonne <gross vehicle weight $\leq$ 38 tonne	Movable Noise Barrier	-5

- 3.4 For each major construction activity, different groups of PMEs for specific purposes will be required. Since the different groups of PMEs cannot operate at the same time in the same location, the group of PMEs with the highest SWL has been used in each case to calculate the noise level of the construction activity to present the worst case scenario.

### **Results and Proposed Mitigation Strategy**

- 3.5 The cumulative impacts for all construction activities for SOH Station and associated plant building have been assessed, and the calculated assessment results for NSRs SOH 5 to SOH 8, which are directly affected by the SOH Station works, are presented in **Appendix C** and summarised in **Table 3.2** below. The proposed mitigation measures described above are included in the assessment and, as such, only the mitigated scenario has been presented.

**Table 3.2 Updated Mitigated Construction Noise Impact at Respective NSRs**

NSR	Maximum Noise Impact from SIL(E), dB(A)					
	Revised Scenario			EIA Assessed Scenario		
	Max Noise Level	Exceedance (and Duration)		Max Noise Level	Exceedance (and Duration)	
SOH 5	76	1-4dB(A) (8 months)	$\geq$ 5dB(A) (0 month)	82	1-4dB(A) (0.5 month)	$\geq$ 5dB(A) (2.5 months)
SOH 6	79	1-4dB(A) (9.5 months)	$\geq$ 5dB(A) (0 month)	81	1-4dB(A) (5.5 months)	$\geq$ 5dB(A) (2.5 months)
SOH 7	75	1-4dB(A) (0 month)	$\geq$ 5dB(A) (0 month)	76	1-4dB(A) (2.5 months)	$\geq$ 5dB(A) (0 month)
SOH 8	77	1-4dB(A) (4.5 months)	$\geq$ 5dB(A) (0 month)	78	1-4dB(A) (3 months)	$\geq$ 5dB(A) (0 month)
PBPS <sup>(1)</sup>	66	1-4dB(A) (0 month)	$\geq$ 5dB(A) (0 month)	68	1-4dB(A) (0 month)	$\geq$ 5dB(A) (0 month)

Note (1): For PBPS, the 'Max Noise Level' indicated in the above table has not taken into account the noise contribution of the EPIW and reference should be made to Section 3.8 for the cumulative noise impact with EPIW.

- 3.6 As shown in **Table 3.2**, by the implementation of quiet plant, noise barriers, enclosures/sheds and acoustic fabric for the PMEs and rescheduling the construction

works as far as possible to avoid cumulative impacts, the maximum construction noise impact can be reduced by between 1dB(A) to 6dB(A) compared to the predicted values in the SIL(E) EIA report for all NSRs within proximity to SOH. In addition, no exceedance is now anticipated at SOH 7. Although the duration of residual impacts are extended, as compared with the EIA assessment, for SOH 5, SOH 6 and SOH 8, the maximum noise levels at these NSRs are have been reduced to 76dB(A), 79dB(A) and 77dB(A) from 82dB(A), 81dB(A) and 78dB(A) respectively. The construction methodology, sequencing and PME adopted for the assessment represents a practical approach within the site and programme constraints of C904. All practical mitigation measures have been adopted.

- 3.7 As indicated in Table 3.32 of the SIL(E) EIA, the predicted construction noise impact at NSR PBPS without the EPIW activities was anticipated to be up to 66dB(A), while the cumulative noise level increases to be up to 74dB(A) when the EPIW works are included. Therefore, it can be concluded that the exceedances at this location are being dominated by the EPIW works which is not covered by the EP.
- 3.8 Since the revised construction schedule and plant inventory for EPIW is not available yet, for the purposes of this NMMP assessment, construction noise impacts induced by the EPIW works have made reference to the assessed activities in the SIL(E) EIA (Activity 10 in SIL(E) EIA), which was anticipated to be 74dB(A) (Appendix 3.4i of SIL(E) EIA) at NSR PBPS. In the revised scenario, taking into account the revised LJHJV construction schedule and plant for the SOH station, and assuming the activities at SOH and EPIW are concurrent, the closest works site to NSR PBPS would be TTM-2C-8 which is about 39m away (refer to **Figure 3.1**). The construction works at TTM 2C-8 comprise "Activity 2C.1 - Piling for Station Body at Cofferdam 2" which will contribute 61dB(A) to the overall construction noise impact. Cumulative impacts would, therefore, be 74.2dB(A) for both EPIW and TTM-2C-8 being undertaken concurrently. It can be concluded therefore, that the construction of the SOH Station would not contribute significant noise impacts at the PBPS.

### **Indirect Technical Remedies**

- 3.9 It should be noted that the use of Indirect Technical Remedies (ITR) as a mitigation measure is neither a requirement stipulated under Annex 13 of the EIAO-TM nor the EIA Study Brief. The provision of ITR is the initiative of the Project Proponent in view of the noise disturbance associated with the construction of the SIL(E). Consideration will be given to make reference to the previous approved EIA of WIL for the eligibility criteria proposed for qualifying NSRs for ITR which would be dependent on the severity of the residual noise impact and duration of exceedance after implementing all practical direct mitigation measures. As noted above, the maximum noise levels, in particular at SOH 5 and SOH 6, have been generally reduced compared to the predicted levels in the SIL(E) EIA report. The use of ITR is considered not necessary based on the Contractor's assessment.
- 3.10 However, communication has already been made to the relevant flats of South Horizons who have been identified as eligible for the proposed ITR with reference to the noise assessment results in the EIA and the provision of installation of double glazed windows has been offered to the affected flats as an additional mitigation measure.

## **4 Conclusion**

- 4.1 With the implementation of the proposed noise mitigation measures, construction noise impacts are now predicted to be reduced in the level of exceedances, except for SOH 7 where no residual impacts are now anticipated.
- 4.2 Further review and update will be performed during the construction phase and liaison with affected parties is essential to minimise the construction noise impacts as far as possible.

**Figure 1.1** Locations of NSRs and Alignment Scheme



**Legend:**

- SIL (E) Alignment
- 300m Study Area
- ↑ SOHS Air Borne Noise Sensitive Receivers

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED
						TENDER SUBMISSION			

DRAWN  
DESIGNED  
CHECKED  
APPROVED  
DATE

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**MTR**

**SOUTH ISLAND LINE (EAST)**

ORIGINATOR

**LEIGHTON** 禮頓  
Leighton - John Holland Joint Venture

**John Holland**

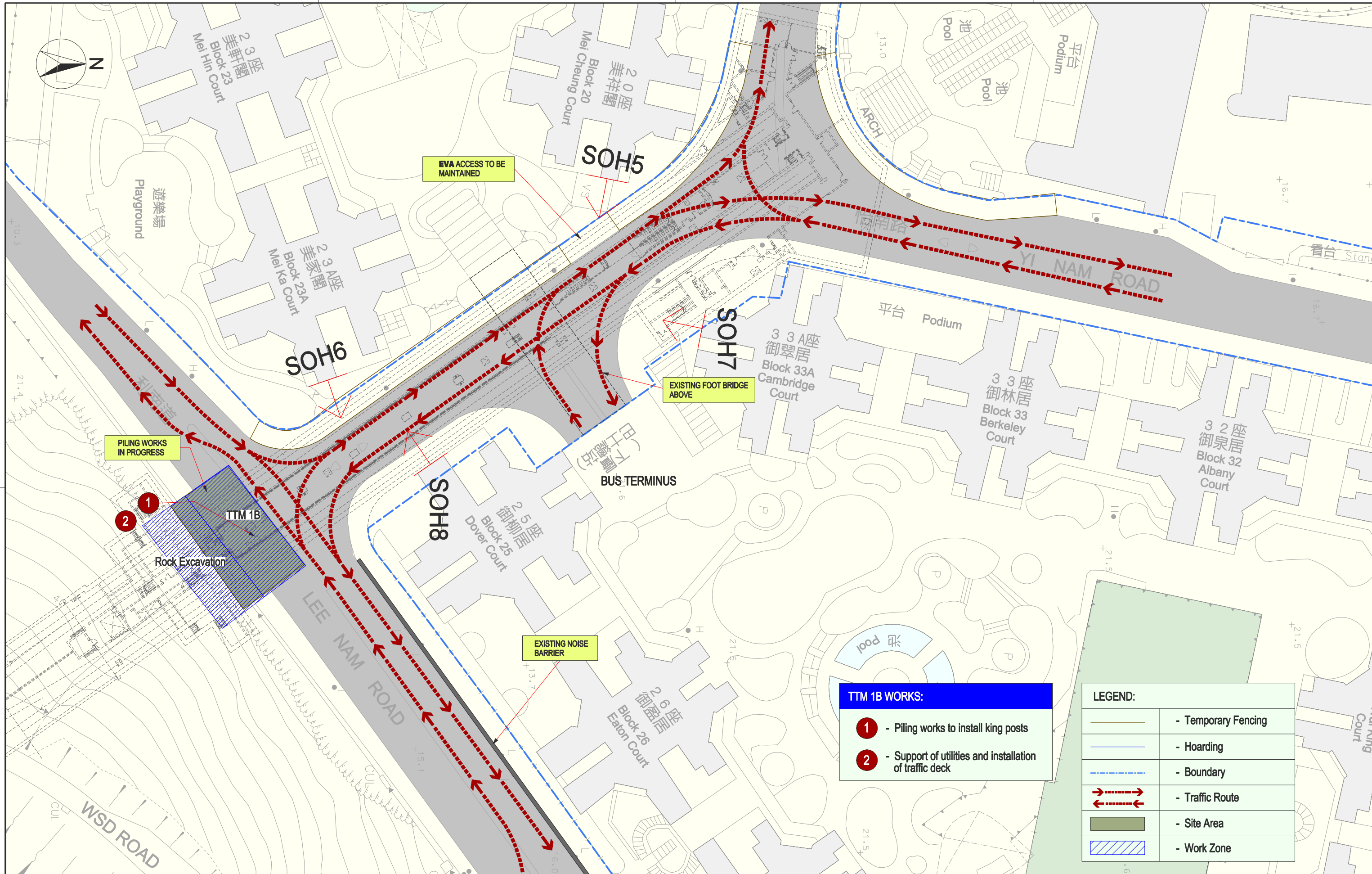
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**Contract 904**  
Locations of NSRs and Alignment Scheme

SCALE @ A1 DRAWING NO. FIGURE 1.1 REV. C

**Figure 2.1 Noise Sensitive Receivers at SOH Station – TTM Stage 1B**



PILING WORKS IN PROGRESS

EVA ACCESS TO BE MAINTAINED

EXISTING FOOT BRIDGE ABOVE

EXISTING NOISE BARRIER

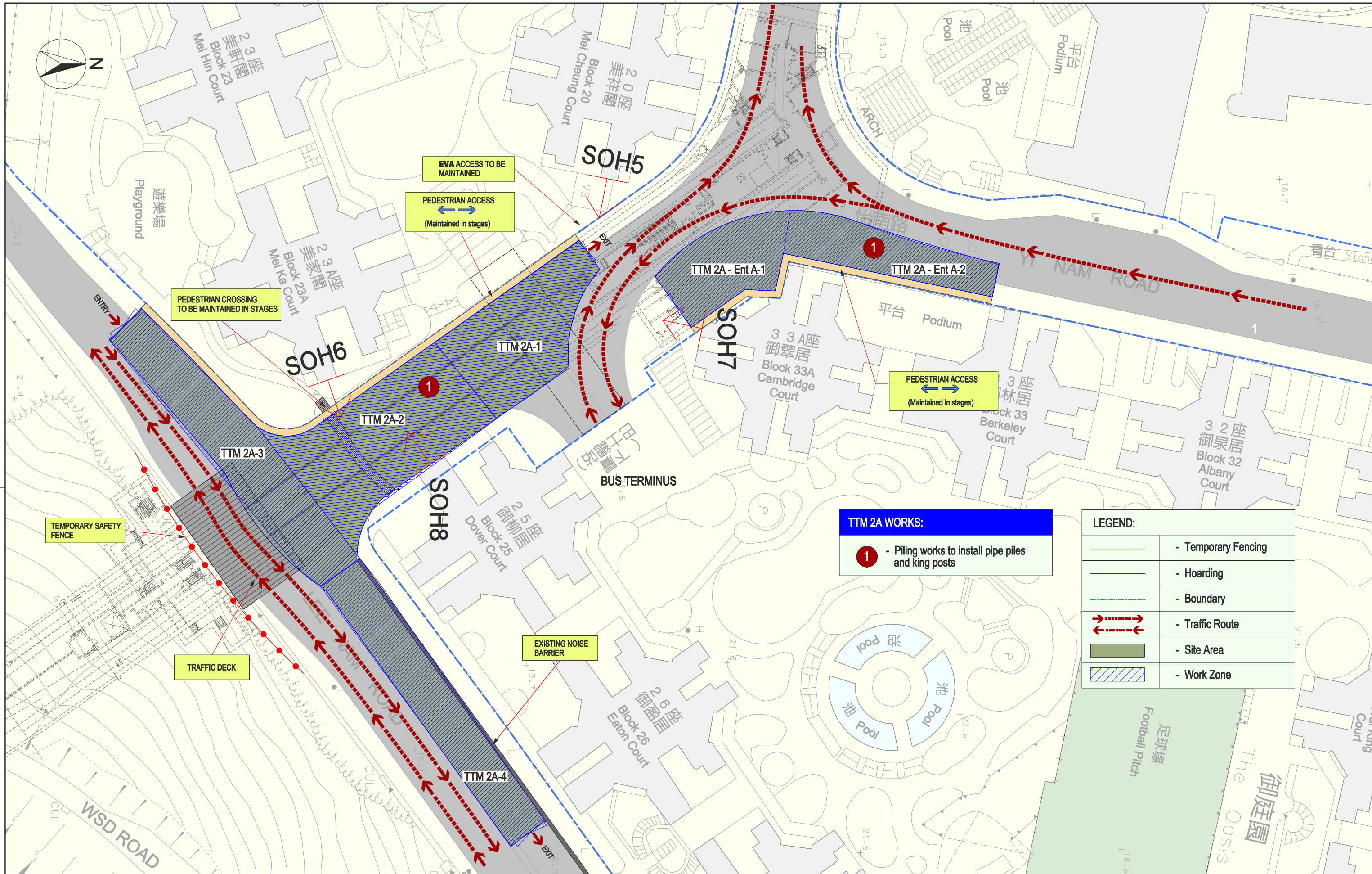
- TTM 1B WORKS:**
- 1 - Piling works to install king posts
  - 2 - Support of utilities and installation of traffic deck

**LEGEND:**

	- Temporary Fencing
	- Hoarding
	- Boundary
	- Traffic Route
	- Site Area
	- Work Zone

DRAWN		CC		MTR		TITLE	
DESIGNED		TF		SOUTH ISLAND LINE (EAST)		Contract 904	
CHECKED		TF		ORIGINATOR		Noise Sensitive Receivers at SOH Station	
APPROVED		KH		LEIGHTON 禮頓		- TTM Stage 1B	
DATE		01/FEB/2011		Leighton - John Holland Joint Venture		SCALE @ A1	
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**Figure 2.2 Noise Sensitive Receivers at SOH Station – TTM Stage 2A**



**TTM 2A WORKS:**  
 ① - Piling works to install pipe piles and king posts

LEGEND:	
	- Temporary Fencing
	- Hoarding
	- Boundary
	- Traffic Route
	- Site Area
	- Work Zone

DRAWN	CC
DESIGNED	TF
CHECKED	TF
APPROVED	KH
DATE	01/FEB/2011

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**MTR**

**SOUTH ISLAND LINE (EAST)**

ORIGINATOR

**LEIGHTON 禮頓** **John Holland**

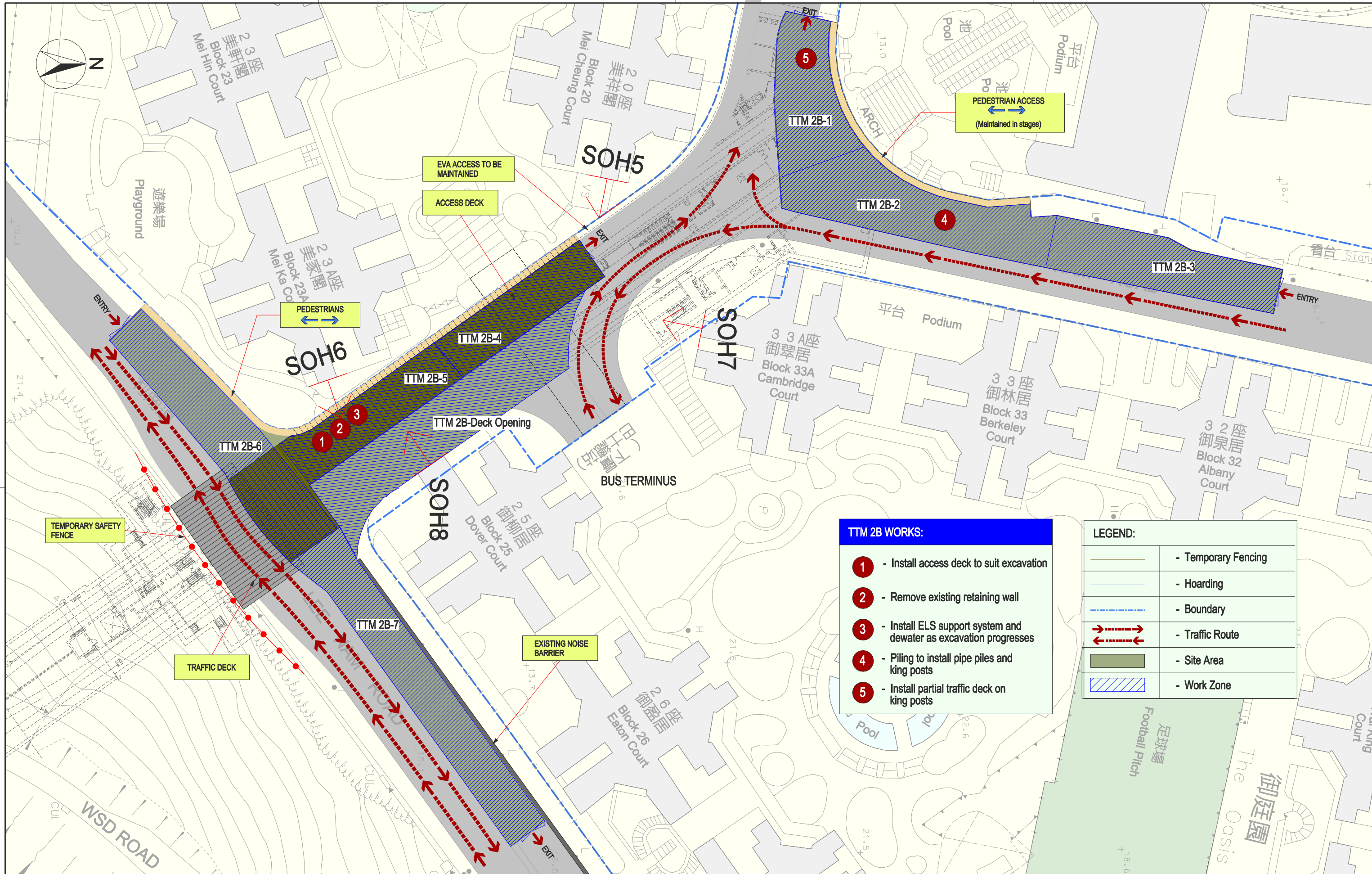
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		Noise Sensitive Receivers at SOH Station	
		- TTM Stage 2A	
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C	TENDER SUBMISSION	TF	01FEB11	KH					

**Figure 2.3 Noise Sensitive Receivers at SOH Station – TTM Stage 2B**



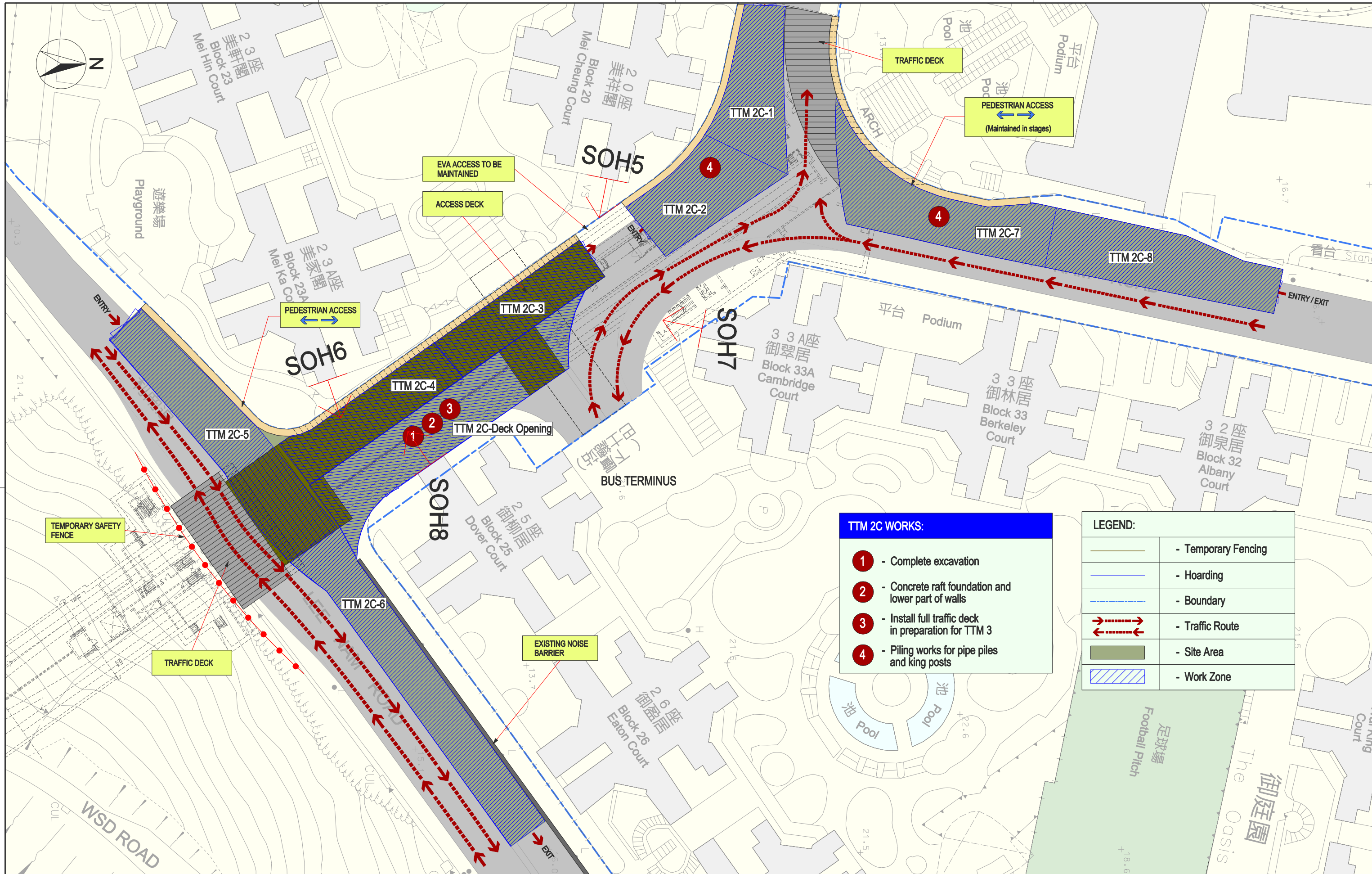
- TTM 2B WORKS:**
- 1 - Install access deck to suit excavation
  - 2 - Remove existing retaining wall
  - 3 - Install ELS support system and dewater as excavation progresses
  - 4 - Piling to install pipe piles and king posts
  - 5 - Install partial traffic deck on king posts

**LEGEND:**

	- Temporary Fencing
	- Hoarding
	- Boundary
	- Traffic Route
	- Site Area
	- Work Zone

DRAWN		CC		<p><b>SOUTH ISLAND LINE (EAST)</b></p>	TITLE		Contract 904	
DESIGNED		TF			Noise Sensitive Receivers at SOH Station		- TTM Stage 2B	
CHECKED		TF			SCALE @ A1		DRAWING NO.	
APPROVED		KH			1:300		FIGURE 2.3	
DATE		01/FEB/2011			CADD REF.		TTM2B_Rev1.dgn	
<small>DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.          © LEIGHTON-JOHN HOLLAND JV COPYRIGHT IN RESPECT OF THIS DRAWING / DOCUMENT IS OWNED BY THE LEIGHTON-JOHN HOLLAND JV OF HONG KONG. NO REPRODUCTION OF THE DRAWING / DOCUMENT OR ANY PART BY WHATEVER MEANS IS PERMITTED WITHOUT THE PRIOR WRITTEN CONSENT OF THE LEIGHTON-JOHN HOLLAND JV.</small>				ORIGINATOR APPROVED DATE BY DATE APPROVED		REV. C TENDER SUBMISSION 01FEB11 KH		
REV	DESCRIPTION	BY	DATE	APPROVED	DESCRIPTION	BY	DATE	APPROVED

**Figure 2.4 Noise Sensitive Receivers at SOH Station – TTM Stage 2C**



DRAWN	CC
DESIGNED	TF
CHECKED	TF
APPROVED	KH
DATE	01/FEB/2011
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**MTR**

**SOUTH ISLAND LINE (EAST)**

ORIGINATOR

**LEIGHTON 禮頓** **John Holland**

Leighton - John Holland Joint Venture

CADD REF. TTM2C\_Rev1.dgn

TITLE

**Contract 904**  
Noise Sensitive Receivers at SOH Station  
- TTM Stage 2C

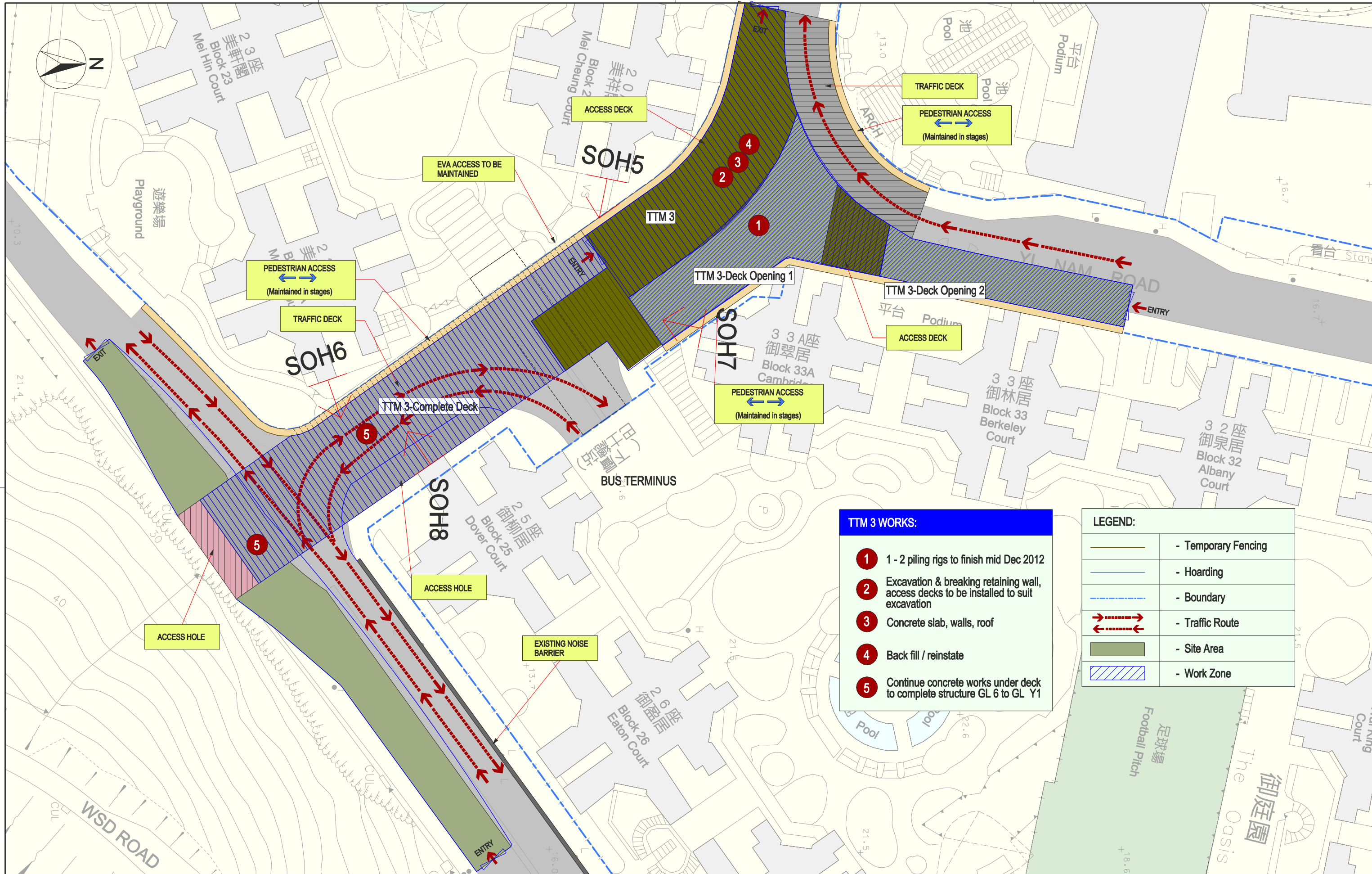
SCALE @ A1  
1:300

DRAWING NO.  
FIGURE 2.4

REV. C

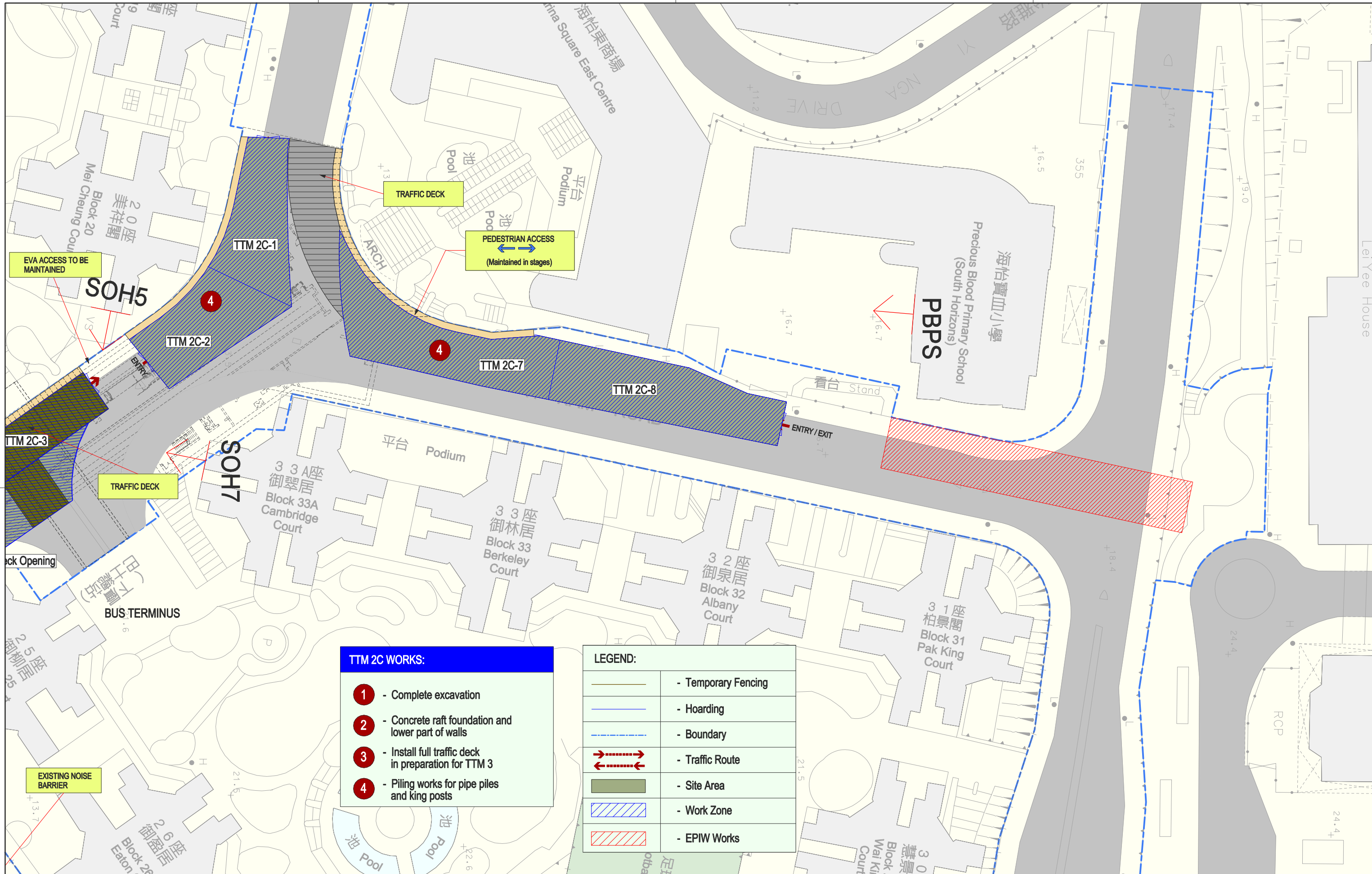
REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED
C	TENDER SUBMISSION	TF	01FEB11	KH					

**Figure 2.5 Noise Sensitive Receivers at SOH Station – TTM Stage 3**



DRAWN		CC		MTR		TITLE	
DESIGNED		TF		SOUTH ISLAND LINE (EAST)		Contract 904	
CHECKED		TF		ORIGINATOR		Noise Sensitive Receivers at SOH Station	
APPROVED		KH		LEIGHTON 禮頓		- TTM Stage 3	
DATE		01/FEB/2011		Leighton - John Holland Joint Venture		SCALE @ A1	
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REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY
C	TENDER SUBMISSION	TF	01FEB11	KH			

**Figure 3.1 Noise Sensitive Receiver PBPS and EPIW during TTM Stage 2C**



- TTM 2C WORKS:**
- 1 - Complete excavation
  - 2 - Concrete raft foundation and lower part of walls
  - 3 - Install full traffic deck in preparation for TTM 3
  - 4 - Piling works for pipe piles and king posts

**LEGEND:**

	- Temporary Fencing
	- Hoarding
	- Boundary
	- Traffic Route
	- Site Area
	- Work Zone
	- EPIW Works

DRAWN		CC				<b>SOUTH ISLAND LINE (EAST)</b>		<b>Contract 904</b> Noise Sensitive Receivers PBPS and EPIW Works During TTM Stage 2C	
DESIGNED		TF							
CHECKED		TF							
APPROVED		KH							
DATE		01/FEB/2011							
ORIGINATOR				SCALE @ A1 1:300		DRAWING NO. FIGURE 3.1		REV. C	
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REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED
C	TENDER SUBMISSION	TF	01FEB11	KH					

## Appendix A Construction Activities and Plant Inventory

**Appendix A**  
**Construction Activities and Plant Inventory for South Horizons Works Site**  
**Mitigated Scenario**

**Construction of Plant Building - Excavation with Conventional Open Cut Method**

Group	PME	TM or other ref.	No. of PME	SWL dB(A)/unit	Screening Effect dB(A)	Noise Mitigation Measure	% on time	Total SWL dB(A)
<b>Activity 1a - Excavate Top Soil</b>								
	Tracked Hydraulic excavator	BS C10/2	2	104	-5	Movable Noise Barrier	70%	100
<b>Total</b>								100
<b>Activity 2a - Excavate in Mixed Ground</b>								
	Rock Drill †	Ref TNS EIA	2	108	-10	Acoustic Fabric	70%	99
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	2	110	-5	Movable Noise Barrier	50%	105
<b>Total</b>								106
<b>Activity 3a - Rock Excavation at Rock Slope</b>								
	Rock Drill †	Ref TNS EIA	2	108	-10	Acoustic Fabric	30%	96
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	2	110	-5	Movable Noise Barrier	30%	103
	Tracked Hydraulic excavator	BS C10/2	2	104	-5	Movable Noise Barrier	30%	97
	Air compressor, air flow > 10m <sup>3</sup> /min and ≤ 30m <sup>3</sup> /min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	2	95	-15	Noise Enclosure	100%	83
	Water pump (electric)	CNP 281	2	88	-15	Noise Enclosure	100%	76
	Crane, tower (electric)	CNP 049	1	95			100%	95
<b>Total</b>								105

**Construction of Plant Building - Construction**

<b>Activity 4 - Construction of Plant Building</b>								
	Air compressor, air flow > 10m <sup>3</sup> /min and ≤ 30m <sup>3</sup> /min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Truck Mixer (5m <sup>3</sup> )	BS D6/35	2	100	-5	Movable Noise Barrier	50%	95
	Concrete pump (100kW)	BS D6/36	1	106	-5	Movable Noise Barrier	20%	94
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	70%	91
	Poker vibratory	BS C4/34	4	97			50%	100
	Water pump, submersible (electric)	CNP 283	1	85	-10	Movable Noise Barrier	100%	75
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80
	Lorry, with crane/grab, 5.5 tonne < gross vehicle weight ≤ 38 tonne	CNP 145	2	105	-5	Movable Noise Barrier	30%	98
	Bar bender and cutter (electric)	CNP 021	1	90	-10	Movable Noise Barrier	50%	77
	Saw, circular, wood	CNP 201	1	108	-10	Movable Noise Barrier	50%	95
<b>Total</b>								104

**Appendix A**  
**Construction Activities and Plant Inventory for South Horizons Works Site**  
**Mitigated Scenario**

**Construction of SOH Station**

<b>TTM Stage 1B</b>									
<b>Activity 1B.1 - Piling near Plant Building</b>									
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	2	102	-15	Noise Enclosure	70%	88	
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	98
<b>TTM Stage 2A</b>									
<b>Activity 2A.2 - Piling for Station Body</b>									
<b>Activity 2A.2a - Yi Nam Road Near Lee Nam Road (Group 1)</b>									
	Drill rig, rotary type (diesel)	CNP 072	2	110	-10	Acoustic Fabric	50%	100	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	100
<b>Activity 2A.2a - Yi Nam Road Near Lee Nam Road (Group 2)</b>									
	Drill rig, rotary type (diesel)	CNP 072	2	110	-10	Acoustic Fabric	50%	100	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	100
<b>Activity 2A.2b - Yi Nam Road Near South Horizon Drive (Group 1)</b>									
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97	
								<b>Total</b>	97
<b>Activity 2A.2b - Yi Nam Road Near South Horizon Drive (Group 2)</b>									
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97	
								<b>Total</b>	97
<b>Activity 2A.2b - Yi Nam Road Near South Horizon Drive (Mobile Cranes Only)</b>									
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	90
<b>Activity 2A.3 - Air Compressors for Drill Rigs</b>									
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	4	102	-15	Noise Enclosure	70%	91	
								<b>Total</b>	91
<b>TTM STAGE 2B</b>									
<b>Activity 2B.1 - Piling for Station Body at Cofferdam #1</b>									
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	6	102	-15	Noise Enclosure	100%	95	
	Drill rig, rotary type (diesel)	CNP 072	3	110	-10	Acoustic Fabric	50%	102	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	25%	87	
								<b>Total</b>	103
<b>Activity 2B.2 - Station Cut &amp; Cover</b>									
<b>Activity 2B.2a - Stationary Plant at unloading area</b>									
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80	
								<b>Total</b>	80
<b>Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Group 1)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	40%	101	
								<b>Total</b>	102
<b>Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Group 2)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	40%	101	
								<b>Total</b>	102
<b>Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Group 3)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96	
								<b>Total</b>	96
<b>Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Mobile Cranes)</b>									
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
	Dump Truck	BS D9/39	1	103			40%	99	
								<b>Total</b>	100
<b>Activity 2B.2c - Excavate in Mixed Ground from +6mPD with half deck (Above Decking)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97	
	Dump Truck	BS D9/39	2	103			40%	102	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	104
<b>Activity 2B.2d - Excavate in Mixed Ground from +6mPD with half deck (Below Decking)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-20	Below Decking	70%	82	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-20	Below Decking	70%	88	
	Water pump (electric)	CNP 281	2	88	-20	Below Decking	100%	71	
								<b>Total</b>	89
<b>Activity 2B.2e - Excavate in Mixed Ground from +6mPD with half deck (At Decking Opening)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	70%	103	
								<b>Total</b>	104

**Appendix A**  
**Construction Activities and Plant Inventory for South Horizons Works Site**  
**Mitigated Scenario**

**Construction of SOH Station**

<b>Activity 2B.2f - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Above Decking</b>								
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97
	Ventilation fan	CNP 241	1	108	-15	Silencer	100%	93
	Dump Truck	BS D9/39	2	103			30%	101
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80
							<b>Total</b>	<b>103</b>
<b>Activity 2B.2g - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Below Decking</b>								
	Tracked Hydraulic excavator	BS C10/2	2	104	-20	Below Decking	70%	85
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	3	110	-20	Below Decking	70%	93
	Water pump (electric)	CNP 281	2	88	-20	Below Decking	100%	71
							<b>Total</b>	<b>94</b>
<b>Activity 2B.2h - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - At Decking Opening</b>								
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97
							<b>Total</b>	<b>97</b>
<b>TTM STAGE 2C</b>								
<b>Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 1)</b>								
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97
							<b>Total</b>	<b>98</b>
<b>Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 2)</b>								
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97
							<b>Total</b>	<b>98</b>
<b>Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 3)</b>								
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97
							<b>Total</b>	<b>98</b>
<b>Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 4)</b>								
	Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	2	102	-15	Noise Enclosure	100%	90
	Drill rig, rotary type (diesel)	CNP 072	1	110	-10	Acoustic Fabric	50%	97
							<b>Total</b>	<b>98</b>
<b>Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Mobile Cranes Only)</b>								
	Tracked mobile crane (132kW, 55t)	BS C3/29	2	98	-5	Movable Noise Barrier	50%	93
							<b>Total</b>	<b>93</b>
<b>Activity 2C.2 - Station Cut &amp; Cover Cofferdam 1</b>								
<b>Activity 2C.2a - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Above Decking</b>								
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97
	Dump Truck	BS D9/39	2	103			40%	102
	Ventilation fan	CNP 241	1	108	-15	Silencer	100%	93
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80
							<b>Total</b>	<b>104</b>
<b>Activity 2C.2b - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - At Decking Opening</b>								
	Tracked Hydraulic excavator	BS C10/2	2	104	-5	Movable Noise Barrier	70%	100
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	2	110	-5	Movable Noise Barrier	70%	106
	Water pump (electric)	CNP 281	2	88	-15	Noise Enclosure	100%	76
							<b>Total</b>	<b>107</b>
<b>Activity 2C.2c - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Below Decking</b>								
	Tracked Hydraulic excavator	BS C10/2	2	104	-20	Below Decking	70%	85
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	2	110	-20	Below Decking	70%	91
	Water pump (electric)	CNP 281	2	88	-20	Below Decking	100%	71
							<b>Total</b>	<b>92</b>
<b>Activity 2C.2d - After Excavation is complete Start Concrete Base and lower Wall - Above Decking</b>								
	Ventilation fan	CNP 241	1	108	-15	Silencer	100%	93
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80
	Concrete lorry mixer	BS D6/33	2	96	-5	Movable Noise Barrier	50%	91
	Concrete pump	BS C3/26	2	103	-5	Movable Noise Barrier	50%	98
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90
							<b>Total</b>	<b>100</b>
<b>Activity 2C.2e - After Excavation is complete Start Concrete Base and lower Wall - At Deck Opening</b>								
	Water pump (electric)	CNP 281	2	88	-15	Noise Enclosure	100%	76
	Poker vibratory	BS C4/34	2	97			50%	97
							<b>Total</b>	<b>97</b>
<b>Activity 2C.2f - After Excavation is complete Start Concrete Base and lower Wall - Under Deck</b>								
	Water pump (electric)	CNP 281	2	88	-15	Noise Enclosure	100%	76
	Poker vibratory	BS C4/34	2	97			50%	97
							<b>Total</b>	<b>97</b>
<b>Activity 2C.2g - Complete Traffic Deck over Cofferdam 1</b>								
	Tracked mobile crane (132kW, 55t)	BS C3/29	2	98	-5	Movable Noise Barrier	50%	93
	Concrete lorry mixer	BS D6/33	2	96	-5	Movable Noise Barrier	50%	91
							<b>Total</b>	<b>95</b>

**Appendix A**  
**Construction Activities and Plant Inventory for South Horizons Works Site**  
**Mitigated Scenario**

**Construction of SOH Station**

<b>TTM Stage 3</b>									
<b>Activity 3.1 - Piling for Station Body</b>									
	Ventilation fan	CNP 241	1	108	-15	Silencer	100%	93	
	Air compressor, air flow > 10m <sup>3</sup> /min and <= 30m <sup>3</sup> /min	CNP 002	4	102	-15	Noise Enclosure	100%	93	
	Drill rig, rotary type (diesel)	CNP 072	2	110	-10	Acoustic Fabric	50%	100	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	102
<b>Activity 3.2 - Concreting at Cofferdam 1, Below Traffic Deck</b>									
	Concrete lorry mixer	BS D6/33	2	96	-5	Movable Noise Barrier	50%	91	
	Concrete pump	BS C3/26	1	103	-5	Movable Noise Barrier	50%	95	
	Ventilation fan	CNP 241	2	108	-15	Silencer	100%	96	
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	2	95	-15	Noise Enclosure	100%	83	
								<b>Total</b>	99
<b>Activity 3.4 - Station Cut &amp; Cover</b>									
<b>Activity 3.4a - Stationary Plant at unloading area</b>									
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80	
								<b>Total</b>	80
<b>Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Group 1)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	40%	101	
								<b>Total</b>	102
<b>Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Group 2)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	40%	101	
								<b>Total</b>	102
<b>Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Group 3)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96	
								<b>Total</b>	96
<b>Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Mobile Cranes Only)</b>									
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
	Dump Truck	BS D9/39	1	103			40%	99	
								<b>Total</b>	100
<b>Activity 3.4c - Excavate in Mixed Ground from +6mPD with half deck (Above Decking)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97	
	Dump Truck	BS D9/39	2	103			40%	102	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	104
<b>Activity 3.4d - Excavate in Mixed Ground from +6mPD with half deck (Below Decking)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-20	Below Decking	70%	82	
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-20	Below Decking	70%	88	
	Water pump (electric)	CNP 281	2	88	-20	Below Decking	100%	71	
								<b>Total</b>	89
<b>Activity 3.4e - Excavate in Mixed Ground from +6mPD with half deck (Rock Breaker At Decking Opening)</b>									
	Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	70%	103	
								<b>Total</b>	103
<b>Activity 3.4e - Excavate in Mixed Ground from +6mPD with half deck (Excavator At Decking Opening)</b>									
	Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	70%	97	
								<b>Total</b>	97
<b>Activity 3.4f - After Excavation is complete Start Concrete Structure Above Decking</b>									
	Ventilation fan	CNP 241	1	108	-15	Silencer	100%	93	
	Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-15	Noise Enclosure	100%	80	
	Concrete lorry mixer	BS D6/33	2	96	-5	Movable Noise Barrier	50%	91	
	Concrete pump	BS C3/26	2	103	-5	Movable Noise Barrier	50%	98	
	Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90	
								<b>Total</b>	100
<b>Activity 3.4g - After Excavation is complete Start Concrete Structure at Deck Opening (Group 1)</b>									
	Water pump (electric)	CNP 281	2	88	-15	Noise Enclosure	100%	76	
	Poker vibratory	BS C4/34	1	97			50%	94	
								<b>Total</b>	94
<b>Activity 3.4g - After Excavation is complete Start Concrete Structure at Deck Opening (Group 2)</b>									
	Water pump (electric)	CNP 281	2	88	-15	Noise Enclosure	100%	76	
	Poker vibratory	BS C4/34	1	97			50%	94	
								<b>Total</b>	94
<b>Activity 3.4h - After Excavation is complete Start Concrete Structure at Under Deck</b>									
	Water pump (electric)	CNP 281	4	88	-15	Noise Enclosure	100%	79	
	Poker vibratory	BS C4/34	2	97			50%	97	
								<b>Total</b>	97

**Appendix A**  
**Construction Activities and Plant Inventory for South Horizons Works Site**  
**Mitigated Scenario**

**Construction of SOH Station**

<b>Activity 3.4i - Reinstate Utilities and Paving</b>									101
<b>Group 1</b>									
Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90		
Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96		
Roller, vibratory	BS D8/30	1	101			50%	98		
<b>Total</b>								101	
<b>Group 2</b>									
Asphalt paver	BS D8/24	1	101			100%	101		
<b>Total</b>								101	
<b>TTM Stage 4</b>									
<b>Activity 4.1 Remove Decking (at 2 locations (TTM3 deck and near Entrance B Deck))</b>									
Dump Truck	BS D9/39	1	103			50%	100		
Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96		
Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	50%	102		
<b>Total</b>								105	
<b>Activity 4.2 - Reinstate Utilities and Paving</b>									
<b>Group 1</b>									
Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90		
Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96		
Roller, vibratory	BS D8/30	1	101			50%	98		
<b>Total</b>								101	
<b>Group 2</b>									
Asphalt paver	BS D8/24	1	101			100%	101		
<b>Total</b>								101	
<b>TTM Stage 5</b>									
<b>Activity 5.1 Remove Decking (near Entrance B Deck)</b>									
Dump Truck	BS D9/39	1	103			50%	100		
Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96		
Tracked excavator fitted with hydraulic rock breaker	BS D8/13	1	110	-5	Movable Noise Barrier	50%	102		
<b>Total</b>								105	
<b>Activity 5.2 - Reinstate Utilities and Paving</b>									
<b>Group 1</b>									
Tracked mobile crane (132kW, 55t)	BS C3/29	1	98	-5	Movable Noise Barrier	50%	90		
Tracked Hydraulic excavator	BS C10/2	1	104	-5	Movable Noise Barrier	50%	96		
Roller, vibratory	BS D8/30	1	101			50%	98		
<b>Total</b>								101	
<b>Group 2</b>									
Asphalt paver	BS D8/24	1	101			100%	101		
<b>Total</b>								101	
<b>EPIW</b>									
<b>Activity 6 - EPIW – Footbridge</b>									
<b>Group 1</b>									
Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	1	102	-15	Enclosure/ Shed	100%	87		
Wheeled Excavator/Loader fitted with Hydraulic Rock Breaker	BS D8/12	1	106			30%	101		
Tracked Crane (62kW)	BS D7/114	1	101			100%	101		
Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-10	Movable Noise Barrier	100%	85		
<b>Total</b>								104	
<b>Group 2</b>									
Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	1	102	-15	Enclosure/ Shed	100%	87		
Breaker, hand-held, mass > 10kg and < 20kg	CNP 024	1	108	-10	Movable Noise Barrier	30%	93		
Lorry, with crane/grab, 5.5 tonne < gross vehicle weight ≤ 38 tonne	CNP 145	1	105			50%	102		
Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-10	Movable Noise Barrier	100%	85		
<b>Total</b>								103	
<b>Group 3</b>									
Bar bender and cutter (electric)	CNP 021	1	90	-10	Movable Noise Barrier	80%	79		
Truck Mixer (5m3)	BS D6/35	1	100			50%	97		
Poker vibrators	BS D6/40	2	98	-10	Movable Noise Barrier	50%	88		
Grout pump	CNP 106	1	105	-10	Movable Noise Barrier	20%	88		
Saw, circular, wood	CNP 201	1	108	-10	Movable Noise Barrier	80%	97		
Generator, super silenced, 70 dB(A) at 7 m	CNP 103	1	95	-10	Movable Noise Barrier	100%	85		
<b>Total</b>								101	

TNS EIA refers to Tsim Sha Tsui Northern Subway EIA

**Appendix B Ground Investigation Record for South Island Line**



**FUGRO**  
**GEOTECHNICAL**  
**SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 1 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57  
 N 811549.56

DATE from: 28/07/2009 to 13/08/2009

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/end	Water Return %	TCR %	SCR %	R.Q.D %	FI	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type					
28/07/2009	SW										13.81	0.00			Grey, CONCRETE SLAB.
1											13.41	0.40			Firm, light yellowish brown (2.5Y/6/4), sandy SILT with some angular fine to coarse gravel of weak to moderately strong tuff. (FILL)
2															
3															
4									1	78-10	10.21	3.60			Dark grey (5R/4/1), grey (7.5YR/6/1) and light yellowish brown (2.5Y/6/4), angular medium to coarse GRAVEL and COBBLES of moderately strong to strong tuff, granite and concrete. (FILL)
5															
6		1.03m at 18:00													
28/07/2009		23/07/2009													
7		1.75m at 08:00													
8															
9	SW 9.00 PW														
10															

<ul style="list-style-type: none"> <li> Small Disturbed Sample</li> <li> Piston sample</li> <li> U78 Undisturbed Sample</li> <li> U100 Undisturbed Sample</li> <li> Mazer Sample</li> <li> 76mm Vibrocore Sample</li> <li> 100mm Vibrocore Sample</li> <li> Vibrocore Sub-sample</li> <li> SPT Liner Sample</li> </ul>	<ul style="list-style-type: none"> <li> Standard Penetration Test</li> <li> In-situ Vane Shear Test</li> <li> Permeability Test</li> <li> Piezometer Test</li> <li> Televue Survey</li> <li> Packer Test</li> <li> Impression Packer Test</li> <li> Water Sample</li> <li> Standpipe</li> <li> Piezometer Tip</li> </ul>	LOGGED <u>P. Zhang</u> DATE <u>12/08/2009</u> CHECKED <u>A.B. Hollinshead</u> DATE <u>25/08/2009</u>
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**REMARKS**

- Drillhole undertaken at the location of Trial Pit No. 912/SIL/ETP260.
- Constant head permeability tests were performed from 18.85m to 21.15m, 24.20m to 26.70m and 28.70m to 30.20m below existing ground level on 03/08/2009, 04/08/2009 and 05/08/2009 respectively.
- Falling head permeability tests were performed from 17.00m to 18.50m and 33.00m to 34.50m below existing ground level on 13/08/2009 and 08/08/2009 respectively.
- A piezometer was installed at 32.00m below existing ground level on 13/08/2009.
- A standpipe was installed at 14.00m below existing ground level on 13/08/2009.



**FUGRO**  
**GEOTECHNICAL**  
**SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 2 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57  
 N 811549.56

DATE from: 28/07/2009 to 13/08/2009

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/end	Water Return %	TCR %	SCR %	RQD %	F1	Tests	Samples			Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type	Depth					
											10.00					As sheet 1 of 7.
28/07/2009 20/07/2009		1.21m at 18:00 2.13m at 08:00		52 55												
12				53												
13		1.56m at 18:00 2.37m at 08:00		59 60												
14				66												
15				67												Dark grey (5R/4/1), angular BOULDERS with occasional cobbles of strong tuff. (FILL)
16				67												
17		1.29m at 18:00 11.80m at 08:00		69												
18		RW 17.00 RW		62												
19				48												Firm, grey (7.5YR/6/1), sandy SILT with some angular fine to medium gravel of moderately strong tuff. (FILL)
20																

- Small Disturbed Sample
- Piston sample
- U78 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- 76mm Vibrocure Sample
- 100mm Vibrocure Sample
- Vibrocure Sub-sample
- SPT Liner Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Pressuremeter Test
- Televiwer Survey
- Packer Test
- Impression Packer Test
- Water Sample
- Standpipe
- Piezometer Tip

LOGGED P. Zhang  
 DATE 12/08/2009  
 CHECKED A.B. Hollinshead  
 DATE 28/08/2009

REMARKS



**FUGRO  
GEOTECHNICAL  
SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 3 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57  
N 811549.56

DATE from: 28/07/2009 to 13/08/2009

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/end	Water Return %	TCR %	SCR %	RQD %	F1	Tests	Samples			Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type	Depth					
21		1.47m at 18:00 11.27m at 08:00						k=8.33E-6m/s 3, 3, 1, 2, 2, 3 N=8	4	23.60						As sheet 2 of 7.
									5	23.70						
									6	23.80						
22											-9.19	22.00				Very soft, grey (7.5YR/6/1), slightly sandy CLAY with occasional fine shell fragments. (MARINE DEPOSIT)
23									8	22.10						
									7	22.20						
24								0, 0, 0, 0, 1, 0 N=1	8	22.70						
									9	22.80						
25								k=3.67E-8m/s	10	24.00						
									11	24.20						
26									12	24.30						
								0, 0, 0, 0, 1 N=1	13	24.80						
27									14	27.10						
28									15	28.10						
29								3, 2, 2, 2, 3, 4 N=11	16	28.70						Firm, light yellowish brown (2.5Y/6/4), sandy SILT with some subangular fine to coarse gravel of weak to moderately strong tuff. (ALLUVIUM)
									17	28.80						
30		6.53m at						k=8.23E-6m/s	18	29.00						

- Small Disturbed Sample
- Piston sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazer Sample
- 76mm Vibrocure Sample
- 100mm Vibrocure Sample
- Vibrocure Sub-sample
- SPT Linear Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Pressuremeter Test
- Televiometer Survey
- Packer Test
- Impression Packer Test
- Water Sample
- Standpipe
- Piezometer Tip

LOGGED P. Zhang  
DATE 12/08/2009  
CHECKED A.B. Hollinshead  
DATE 25/08/2009

REMARKS



**FUGRO  
GEOTECHNICAL  
SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 4 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57

DATE from: 26/07/2009 to 13/08/2009

N 811649.56

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

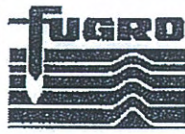
GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/end	Water Return %	TCR %	SCR %	RQD %	F1	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type					
18.00 11.80m at 08:00									19	T2101	-16.19	30.00			As sheet 3 of 7.
31									20	T2101	-17.19	31.00		V	Extremely weak, light yellowish brown (2.5Y8/4), completely decomposed fine ash vitric TUFF. (Stiff, sandy SILT with some fine to medium gravel)
32									21	T2101		31.00			
33								4, 6, 7, 10, 12, 13 N=42	22	T2101		31.00			
34								k=4.15E-8m/s	23	T2101		31.00			
4.67m at 18:00 11.55m at 08:00									24	T2101		31.00			
35					0	0			25	T2101	-20.69	34.50		IV	Weak, light yellowish brown, highly decomposed fine ash vitric TUFF. (Recovered as silty angular fine to coarse gravel)
36										T2101		35.93			
37					0	0	NI			T2101		37.45			
38					0	0				T2101	-24.55	38.35		V	38.36 - 38.70m : No recovery, assumed to be completely decomposed TUFF.
4.60m at 18:00 11.47m at 08:00							NR			T2101	-24.89	38.70		IV	
40					0	0				T2101	-25.28	39.10		IV	Weak, grey, highly decomposed fine ash vitric TUFF. (Recovered as angular fine to coarse gravel)
										T2101	-28.19	40.00			

- Small Disturbed Sample
- Piston sample
- U78 Undisturbed Sample
- U100 Undisturbed Sample
- Mazer Sample
- 76mm Vibrocore Sample
- 100mm Vibrocore Sample
- Vibrocore Sub-sample
- SPT Liner Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Pressuremeter Test
- Televiewer Survey
- Packer Test
- Impression Packer Test
- Water Sample
- Standpipe
- Piezometer Tip

LOGGED P. Zhang  
 DATE 12/08/2009  
 CHECKED A.B.Hollinshead  
 DATE 25/08/2009

REMARKS



**FUGRO**  
**GEOTECHNICAL**  
**SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 5 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57  
 N 811549.56

DATE from: 28/07/2009 to 13/08/2009

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/end	Water Return %	TCR %	SCR %	RQD %	FI	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type					
41				90	0	0					-28.19	40.00		IV	As sheet 4 of 7.
				85	0	0	NI		T2101		-40.40				
42				100	0	0			T2101		-27.79	41.60		III	Moderately weak to moderately strong, grey, moderately decomposed fine ash vitric TUFF.
				100	0	0			T2101		-41.80				Generally extremely closely to very closely fractured, where intact joints are very closely spaced, rough planar, extremely narrow, iron and manganese oxide stained, kaolin coated, dipping at 20°-30° and subvertical.
43				100	8	0	>20		T2101		-42.55				
44				100	0	0	NI		T2101		-43.50				
		6.60m at 18:00 11.63m at 08:00		100	0	0	>20		T2101		-44.30				
45				100	48	0	7.7		T2101		-44.81	44.81		III	Moderately strong, grey, moderately decomposed fine ash vitric TUFF.
				100	43	0	14.0		T2101		-45.29				Generally very closely fractured, where intact joints are very closely to closely spaced, rough planar and stepped, extremely narrow, iron and manganese oxide stained, chlorite and kaolin coated, dipping at 20°-30°, 50°-60° and subvertical.
46				100	0	0	>20		T2101		-45.99				
47				100	11	0	20.0		T2101		-46.79				
				100	23	0	7.1		T2101		-47.51				
48				100	0	0	>20		T2101		-48.41				
		5.60m at 18:00 12.20m at 08:00		100	0	0	>20		T2101		-48.96				
50				100	0	0	>20		T2101		-49.70				
									T2101		-38.18	60.00			

<ul style="list-style-type: none"> <li> Small Disturbed Sample</li> <li> Piston sample</li> <li> U76 Undisturbed Sample</li> <li> U100 Undisturbed Sample</li> <li> Mixer Sample</li> <li> 76mm Vibrocure Sample</li> <li> 100mm Vibrocure Sample</li> <li> Vibrocure Sub-sample</li> <li> SPT Liner Sample</li> </ul>	<ul style="list-style-type: none"> <li> Standard Penetration Test</li> <li> In-situ Vane Shear Test</li> <li> Permeability Test</li> <li> Pressuremeter Test</li> <li> Televiwer Survey</li> <li> Packer Test</li> <li> Impression Packer Test</li> <li> Water Sample</li> <li> Standpipe</li> <li> Piezometer Tip</li> </ul>	<p>LOGGED <u>P. Zhang</u></p> <p>DATE <u>12/08/2009</u></p> <p>CHECKED <u>A.B-Hollinshead</u></p> <p>DATE <u>25/08/2009</u></p>
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REMARKS



**FUGRO  
GEOTECHNICAL  
SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 6 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57

N 811549.56

DATE from: 28/07/2009 to 13/08/2009

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/end	Water Return %	TCR %	SCR %	ROD %	F.I.	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type					
				97	0	0					-38.19	60.00			As sheet 5 of 7.
51				19	0	0	NR				-36.89	60.40			No recovery, assumed to be completely decomposed TUFF.
		5.83m at 16:00		81	0	0	>20				-37.65	51.67			<p>Strong, light grey, slightly decomposed fine ash vitric TUFF with very closely inclined joints and slightly silicified.</p> <p>Joints are very closely to closely spaced, rough planar and stepped, extremely narrow, chlorite and kaolin coated, dipping at 10°-20°, 20°-30°, 50°-80° and subvertical.</p>
	HW 82.10	11.90m at 08:00		100	100	0					-51.87				
53				100	54	0	11.4				-52.10				
				100	54	0	>20				-52.43				
54				100	56	0	17.8				-53.45				
				100	56	0	>20				-54.54				
55				100	53	0	14.0				-55.70				
				100	86	45	7.1				-56.80				
57				100	54	0	>20				-57.72				
				100	52	0	>20				-58.97				
58				100	0	0	>20				-59.77				
		5.71m at 18:00		100	0	0	>20				-45.69	59.80			Strong, grey, slightly decomposed fine ash vitric
60		12.09m at 08:00									60.00				

- Small Disturbed Sample
- Piston sample
- U78 Undisturbed Sample
- U100 Undisturbed Sample
- Mazur Sample
- 76mm Vibrocore Sample
- 100mm Vibrocore Sample
- Vibrocore Sub-sample
- SPT Liner Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Pressuremeter Test
- Televiometer Survey
- Packer Test
- Impression Packer Test
- Water Sample
- Standpipe
- Piezometer Tip

LOGGED P. Zhang  
 DATE 12/08/2009  
 CHECKED A.B. Hollinshead  
 DATE 28/08/2009

REMARKS



**FUGRO  
GEOTECHNICAL  
SERVICES LTD**

**DRILLHOLE RECORD**

HOLE No. 912/SIL/D265

CONTRACT No.: MTR contract 912

SHEET: 7 of 7

PROJECT: Ground Investigation for South Island Line (East)

METHOD: Rotary Drilling

CO-ORDINATES:

WORKS ORDER No. N/A

MACHINE & No.: FDR-56

E 833410.57

N 811549.56

DATE from: 28/07/2009 to 13/08/2009

FLUSHING MEDIUM: Water

ORIENTATION: Vertical

GROUND LEVEL + 13.81 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	TCR %	SCR %	RQD %	FI	Tests	Samples			Reduced Level	Depth (m)	Legend	Grade	Description
									No.	Type	Depth					
61		4.20m at 18.00		100	100	42						-46.19	60.00		II	TUFF. Joints are very closely to closely spaced, rough planar and stepped, extremely narrow, chlorite and kaolin coated, dipping at 10°-20°, 20°-30°, 50°-60° and subvertical.
				100	100	0						-47.79	61.60			End of investigation hole at 61.60m.
62																
63																
64																
65																
66																
67																
68																
69																
70													70.00			

- Small Disturbed Sample
- Piston sample
- U78 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- 78mm Vibrocure Sample
- 100mm Vibrocure Sample
- Vibrocure Sub-sample
- SPT Liner Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Pressurimeter Test
- Televiometer Survey
- Packer Test
- Impression Packer Test
- Water Sample
- Standpipe
- Piezometer Tip

LOGGED P. Zhang  
 DATE 12/08/2009  
 CHECKED A.B. Hollinshead  
 DATE 25/08/2009

REMARKS

**Appendix C Construction Schedule with Air-borne Noise Assessment (Mitigated Scenario)**















**Appendix C**  
**Construction Schedule with Air-borne Noise Assessment**  
**Mitigated Scenario**

**SOH 8 - Dover Court (Block 25)**

Construction Element	Notional Source	SWL	Dist	SPL	2013												2014			
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
<b>Plant Building</b>																				
<b>Construction of Plant Building - Excavation with Conventional Open Cut Method</b>																				
Activity 1a - Excavate Top Soil	Rock Excavation	100	41	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63		
Activity 2a - Excavate in Mixed Ground	Rock Excavation	106	41	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
Activity 3a - Rock Excavation at Rock Slope	Rock Excavation	105	41	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	
<b>Construction of Plant Building</b>																				
Activity 4 - Construction of Plant Building	Plant Building	104	35	68									68	68	68	68	68	68	68	
<b>SOH Station</b>																				
<b>TTM Stage 1B</b>																				
Activity 1B.1 - Piling near Plant Building	Plant Building	98	35	62																
<b>TTM Stage 2A</b>																				
<b>Activity 2A.2 - Piling for Station Body</b>																				
Activity 2A.2a - Yi Nam Road Near Lee Nam Road (Group 1)	TTM 2A-1	100	27	66																
Activity 2A.3 - Air Compressors for Drill Rigs	TTM 2A-Compressor 2	91	28	57																
Activity 2A.2a - Yi Nam Road Near Lee Nam Road (Group 2)	TTM 2A-2	100	16	71																
Activity 2A.3 - Air Compressors for Drill Rigs	TTM 2A-Compressor 1	91	17	61																
Activity 2A.2b - Yi Nam Road Near South Horizon Drive (Group 1)	TTM 2A-Ent A-1	97	--	0																
Activity 2A.2b - Yi Nam Road Near South Horizon Drive (Group 2)	TTM 2A-Ent A-2	97	59	57																
Activity 2A.2b - Yi Nam Road Near South Horizon Drive (Mobile Cranes Only)	TTM 2A-Ent A-2	90	59	50																
Activity 2A.3 - Air Compressors for Drill Rigs	TTM 2A-Compressor 3	91	66	50																
<b>TTM STAGE 2B</b>																				
Activity 2B.1 - Piling for Station Body at Cofferdam #1	TTM 2B-1	103	90	59																
<b>Activity 2B.2 - Station Cut &amp; Cover</b>																				
Activity 2B.2a - Stationary Plant at unloading area	TTM 2B-Compressor 1	80	--	0																
Activity 2B.2a - Stationary Plant at unloading area	TTM 2B-Compressor 2	80	--	0																
Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Group 1)	TTM 2B-Deck Opening (Surface)	102	15	73																
Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Group 2)	TTM 2B-5	102	19	71																
Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Group 3)	TTM 2B-4	96	31	61																
Activity 2B.2b - Excavate in Mixed Ground from Surface to +6mPD (Mobile Cranes)	TTM 2B-4	100	31	65																
Activity 2B.2c - Excavate in Mixed Ground from +6mPD with half deck (Above Decking)	TTM 2B-4	104	31	69																
Activity 2B.2d - Excavate in Mixed Ground from +6mPD with half deck (Below Decking)	TTM 2B-4 Underground	89	35	53																
Activity 2B.2e - Excavate in Mixed Ground from +6mPD with half deck (At Decking Opening)	TTM 2B-Deck Opening (Underground Level)	104	22	72																
Activity 2B.2f - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Above Decking	TTM 2B-4	103	31	68																
Activity 2B.2g - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Below Decking	TTM 2B-4 Underground	94	35	58																
Activity 2B.2h - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - At Decking Opening	TTM 2B-Deck Opening (Underground Level)	97	22	65																
<b>TTM STAGE 2C</b>																				
Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 1)	TTM 2C-1	98	82	55																
Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 2)	TTM 2C-2	98	63	57																
Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 3)	TTM 2C-7	98	--	0																
Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Group 4)	TTM 2C-8	98	--	0																
Activity 2C.1 - Piling for Station Body at Cofferdam 2 (Mobile Cranes Only)	TTM 2C-2	93	63	52																
<b>Activity 2C.2 - Station Cut &amp; Cover Cofferdam 1</b>																				
Activity 2C.2a - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Above Decking	TTM 2C-5	104	39	67																
Activity 2C.2b - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - At Decking Opening	TTM 2C-Deck Opening	107	22	75																
Activity 2C.2c - Excavate in Rock from +6mPD with half deck (Following excavation of Mixed Ground Above) - Below Decking	TTM 2C-5 Underground	92	35	56																
Activity 2C.2d - After Excavation is complete Start Concrete Base and lower Wall - Above Decking	TTM 2C-5	100	39	63																
Activity 2C.2e - After Excavation is complete Start Concrete Base and lower Wall - At Deck Opening	TTM 2C-Deck Opening	97	22	65																
Activity 2C.2f - After Excavation is complete Start Concrete Base and lower Wall - Under Deck	TTM 2C-5 Underground	97	35	61																
Activity 2C.2g - Complete Traffic Deck over Cofferdam 1	TTM 2C-Complete Deck	95	22	63																
<b>TTM Stage 3</b>																				
Activity 3.1 - Piling for Station Body	TTM 3-1	102	59	62																
Activity 3.2 - Concreting at Cofferdam 1, Below Traffic Deck	TTM 3-Complete Deck	99	23	67																
<b>Activity 3.4 - Station Cut &amp; Cover</b>																				
Activity 3.4a - Stationary Plant at unloading area	TTM 3-1	80	59	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Group 1)	TTM 3-1	102	59	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	
Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Group 2)	TTM 3-Deck Opening 1	102	59	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	
Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Group 3)	TTM 3-Deck Opening 2	96	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Activity 3.4b - Excavate in Mixed Ground from Surface to +6mPD (Mobile Cranes Only)	TTM 3-1	100	59	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	
Activity 3.4c - Excavate in Mixed Ground from +6mPD with half deck (Above Decking)	TTM 3-1	104	59	64					64	64	64	64	64	64	64					
Activity 3.4d - Excavate in Mixed Ground from +6mPD with half deck (Below Decking)	TTM 3-1 Underground	89	61	48					48	48	48	48	48	48	48					
Activity 3.4e - Excavate in Mixed Ground from +6mPD with half deck (Rock Breaker At Decking Opening)	TTM 3-Deck Opening 1 (Underground)	103	61	62					62	62	62	62	62	62	62					
Activity 3.4e - Excavate in Mixed Ground from +6mPD with half deck (Excavator At Decking Opening)	TTM 3-Deck Opening 2 (Underground)	97	--	0					0	0	0	0	0	0	0					
Activity 3.4f - After Excavation is complete Start Concrete Structure Above Decking	TTM 3-1	100	59	60									60	60	60	60				
Activity 3.4g - After Excavation is complete Start Concrete Structure at Deck Opening (Group 1)	TTM 3-Deck Opening 1 (Underground)	94	61	53									53	53	53	53				
Activity 3.4g - After Excavation is complete Start Concrete Structure at Deck Opening (Group 2)	TTM 3-Deck Opening 2 (Underground)	94	--	0									0	0	0	0				
Activity 3.4h - After Excavation is complete Start Concrete Structure at Under Deck	TTM 3-1 Underground	97	61	56									56	56	56	56				
Activity 3.4i - Reinstate Utilities and Paving	TTM 3-Complete Deck	101	23	69													69	69	69	
<b>TTM Stage 4</b>																				
Activity 4.1 Remove Decking (at 2 locations (TTM3 deck and near Entrance B Deck)	TTM 3-Complete Deck	105	23	73													73	73	73	
Activity 4.2 - Reinstate Utilities and Paving	TTM 3-Complete Deck	101	23	69													69	69	69	
<b>TTM Stage 5</b>																				
Activity 5.1 Remove Decking (near Entrance B Deck)	TTM 2C-3	105	31	70													70	70	70	
Activity 5.2 - Reinstate Utilities and Paving	TTM 2C-3	101	31	66													66	66	66	
<b>Cumulative Noise Level Exceedances</b>					73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	



