

IN THE MATTER

of the Resource Management Act 1991

AND

IN THE MATTER

of Resource Consents and Notices of Requirement for the Central Interceptor main project works under the Auckland Council District Plan (Auckland City Isthmus and Manukau Sections), the Auckland Council Regional Plans: Air, Land and Water; Sediment Control; and Coastal, and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

**STATEMENT OF EVIDENCE OF MATHEW JOHN COTTLE ON BEHALF OF
WATERCARE SERVICES LIMITED**

NOISE

1. INTRODUCTION

- 1.1 My name is Mathew John Cottle and I am an acoustic consultant employed by Marshall Day Acoustics Ltd ("**MDA**"). I hold a Masters degree in Design Science (Audio and Acoustics) from the University of Sydney, New South Wales, Australia. I am a current member of the New Zealand Acoustical Society.
- 1.2 I have 6 years experience in acoustic consulting in both Australia and New Zealand, specialising in environmental noise control and computer noise modelling. I have been involved in investigating and reporting on numerous environmental noise matters. I have been involved in a large number of projects including those relating to wind farms, electricity storage and generation, and large industrial operations both here and in Australia.

Involvement in the Central Interceptor Project

- 1.3 I have been involved with the Central Interceptor Project ("**Project**") since 2011. I attended the initial briefing with Watercare Services Limited ("**Watercare**"). My responsibilities on this Project include the authoring of all reports in relation to the assessment of potential noise effects. I have also visited all of the proposed construction sites and have been involved to some extent in the consultation on the Project.

Code of Conduct

- 1.4 I have read the Code of Conduct for Expert Witnesses contained in the Environment Court's Updated Practice Note 2011 which took effect on 1 November 2011 and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

- 1.5 The wider context of the Project, the reasons it is needed, and the benefits it will provide have been explained in the evidence of Mr Munro and Mr Cantrell.
- 1.6 The purpose of my evidence is to address issues relating to potential noise effects generated during the construction of the Project and to confirm there will be no noise effects from its operation.
- 1.7 My evidence is structured as follows:
- (a) Executive summary;
 - (b) Project description;
 - (c) Assessment methodology;
 - (d) Noise controls and proposed use of management plans;
 - (e) Predicted construction noise levels;
 - (f) Operational noise levels;

- (g) Response to submissions;
- (h) Response to Council Pre-hearing Report; and
- (i) Conclusions.

1.8 A Glossary of Technical Acoustical Terms is attached in **Appendix A**.

1.9 My evidence relates to the information contained in the noise impact assessment carried out by MDA ("**Noise Report**") and submitted as Technical Report F of Part D of the Central Interceptor Main Project Works Assessment of Effects on the Environment submitted to the Council in August 2012 ("**AEE**"), Technical Appendix D of the Mount Albert War Memorial Reserve Assessment of Effects on the Environment submitted to the Council in March 2013, and generally to further information provided in Watercare's Section 92 Responses (dated December 2012 and May 2013). It also responds to matters raised in the Council's Pre-hearing Report, and addresses issues raised in submissions.

2. EXECUTIVE SUMMARY

Introduction

2.1 I and my colleagues at MDA, including Mr Warren who has over 40 years experience, have assessed the acoustic effects relating to this Project, which cover both construction and operation noise.

2.2 Construction noise is the principal acoustical matter considered in the noise impact assessment as it involves a large number of work sites with, in some instances, noisy, heavy earthmoving and other machinery being required to operate in the vicinity of dwellings.

2.3 The total period of construction activity is anticipated to be 5 years, with construction periods ranging from 12 months at secondary construction sites up to 5 years at primary construction sites.

Noise Assessment

2.4 We inspected all sites to determine the relevant acoustical factors, including the locations of nearest dwellings and other noise sensitive receivers. These

were then incorporated into each noise model, and used to assess the existing noise environments.

- 2.5 Using computer modelling, the construction noise levels were predicted for noise-sensitive receivers around each site based on site characteristics and equipment expected to be used. The predicted construction levels were then assessed against the proposed noise rules ("**Project Noise Controls**") and, in circumstances where these were exceeded, we identified possible noise mitigation measures.

Operation Noise

- 2.6 On-going operational noise of the Central Interceptor would be confined to mechanical air treatment facilities ("**ATFs**"). These can be readily designed and constructed incorporating conventional noise control engineering methods to ensure compliance with recommended noise controls.

Project Noise Controls

- 2.7 The entire Project is within the jurisdiction of the Auckland Council. For this reason I consider it appropriate and practical to have one consistent set of noise controls for the Project. These recommended controls take into consideration the various provisions of the current regional and district plans of relevance, the existing ambient sound environment, the need for adequate protection of occupiers in the vicinity, and the current New Zealand Acoustical Standards. The proposed controls are contained in Watercare's Proposed Conditions.

Predicted Noise Levels

- 2.8 The construction noise levels predicted to be received at dwellings and other noise-sensitive receivers in the vicinity of construction activity at the various sites, range from readily compliant without the need for mitigation, to achieving compliance with implementation of mitigation measures, to minor exceedances

despite mitigation, and in a few instances, significant exceedances of the proposed Project Noise Controls.

- 2.9 These exceedances would be addressed by the provisions of the Construction Noise and Vibration Management Plan ("CNVMP") which will include methods for individual consultation with potentially affected occupiers, with the aim of developing mutually acceptable strategies for addressing unacceptable noise impacts over the period of construction.
- 2.10 The mitigation intended to be implemented would involve measures such as the selection of quieter equipment, the erection of noise barriers or enclosures around noisy activities, limitation of times for noisy activity, and notification of residents describing intended works together with contractors contact details.
- 2.11 In circumstances where significant exceedances may occur, strategies would involve organising noisy activities to take place only when residents are absent, or in exceptional circumstances for example, where noisy night-time works are necessary, provision of alternative accommodation.

Submissions

- 2.12 Twenty-five submissions refer to noise as a matter of concern. A number of the submissions refer to noise in a general manner and others to specific issues.
- 2.13 These issues include requests for: noise barriers of increased height and different materials of construction, double-glazing and mechanical ventilation, modified hours for construction activity, monitoring of noise levels, advance notification of works, acoustic enclosures over shafts and noise effects on dwellings and users of the Mount Albert War Memorial Reserve.
- 2.14 The proposed mitigation measures and the provisions of the CNVMP have been developed so as to ensure compliance with the noise limits of the Construction Noise Standard NZS 6803:1999 insofar as it is practicable to do so. Where full compliance cannot be achieved flexibility is required to enable the construction of this significant infrastructure project. While the proposed approach to managing noise does not satisfy all of the matters raised by the submitters, I observe that the mitigation measures are optimised for

compliance and practicality. I observe that the degree of protection against construction noise effects needs to be balanced with the need for society to progress and the significant benefits to the community from the implementation of the Project.

- 2.15 A further issue for consideration is that construction activity is of finite duration, and any reduction in hours of work would have the effect of lengthening the overall period of construction and therefore potential noise impact.
- 2.16 Also pertinent is the fact that the vast majority of construction sites have been located in public reserves. It is preferable to impose construction noise on reserve land instead of on dwellings, as occupation of any reserve is optional, of short duration and sleep disturbance is not an issue. These factors do not generally apply to residences.
- 2.17 The issues of monitoring of construction noise and advance notification of works are addressed in the CNVMP and will deal with individual sites where appropriate.
- 2.18 The primary construction sites of Western Springs and May Road will have enclosures over the shafts. This is not warranted, and is not needed for compliance, at the secondary sites so is not proposed.
- 2.19 I observe also that it is not possible or practicable for construction noise to comply with the district plan limits for normal everyday activities. Any attempt to achieve such compliance would stifle or potentially prevent much development. I am satisfied that the concerns of submitters can be adequately addressed through the Proposed Designation Conditions which include the formulation of a CNVMP.

Council Pre-hearing Report

- 2.20 I have read the Council Pre-hearing Report and associated report of Mr Styles, as they relate to noise. The reports recommended a number of amendments and additions to the Proposed Designation Conditions relating to noise. I generally support the proposed changes although I do recommend some amendments, discussed in further detail in Section 9 below.

2.21 The Pre-hearing Report recommended that evidence be provided as to whether further amendments or mitigation measures are needed in relation to NoR3 (Plan Modification 357) for the Mount Albert War Memorial Reserve Car Park site and adjacent noise sensitive receivers. I note that where the Best Practicable Option ("BPO") is adopted in conjunction with proposed Designation Condition CNV.4, I consider an acceptable outcome can be achieved and therefore conclude that no further amendments or mitigation measures are necessary in relation to the Car Park Site and any potential effects on the tenants of the nearby house owned by Community of Refuge Trust ("CORT").

Conclusion

2.22 I conclude that the noise generated by construction activity can, in the main, comply with the Project Noise Controls. Where non-compliance is predicted, practicable mitigation and management measurements would be implemented through the CNVMP including consultation with affected parties to achieve acceptable outcomes. I consider that where the BPO is adopted, in conjunction with community consultation and feedback via the CNVMP, this would result in the construction noise effects being controlled to acceptable levels.

2.23 Operation noise generated by the Project would be compliant and any noise effects would be no more than minor.

3. PROJECT DESCRIPTION

3.1 The Project is described in detail in Part A of the AEE. It is also described in detail in the following briefs of evidence:

- (a) *The Project overview by Mr Munro.*
- (b) *The concept design evidence presented by Mr Cantrell.*
- (c) *The construction evidence presented by Mr Cooper.*

- 3.2 I have not therefore included a detailed summary of the technical aspects of the Project, and instead rely on the information presented in the AEE and those briefs of evidence. As such, the following briefly describes the operational arrangements and construction overview for the Project, as relevant to this evidence.
- 3.3 As set out in the evidence of Mr Cantrell, the Project involves both primary and secondary construction sites (these are listed in the **Key Facts Table**¹).
- 3.4 For all sites, construction activities are anticipated to occur on the following general basis:
- (a) *Tunnelling activities* underground – 24 hours a day 7 days a week related to main tunnel works. These activities would include tunnel spoil removal to above ground at certain sites.
 - (b) *Microtunnelling activities* underground – 7.00am to 6.00pm Monday to Friday and 8.00am to 6.00pm Saturday under normal operations. However, in special circumstances, Watercare may need to undertake works 24 hours a day, 7 days a week (or alternative extended hours) to meet construction demands, provided that construction work can be managed to meet the relevant noise controls. These activities would include tunnel spoil removal to above ground at certain sites.
 - (c) *Truck movements* – 7.00am to 6.00pm Monday to Friday, 8.00am to 6.00pm Saturday.
 - (d) *Special deliveries* – as required to address traffic management hours.
 - (e) *General site activities above ground including shaft excavation and all structure works* – 7.00am to 6.00pm Monday to Friday, 8.00am to 6.00pm Saturday with provision to extend hours during summer daylight savings periods as required.
- 3.5 General site activities are anticipated to take place during normal day-time construction hours. However, flexibility is required to enable these sites to also operate in the night-time period where circumstances require this to occur. It is

¹ Hearing Drawing Set, pages 1-3.

emphasised that any critical above ground night-time works would be of short-term duration and would be managed via the proposed CNVMP as set out in the Proposed Designation Conditions.

Construction Overview

3.6 As generally set out in the evidence of Mr Cantrell and Mr Cooper, the following activities are proposed to occur at the construction sites:

- (a) site establishment using excavators, loaders, trucks etc;
- (b) controlled blasting where basalt is present, and otherwise rock breaking using excavators;
- (c) shaft excavation using excavators, cranes and spoil removal by truck;
- (d) shaft piling and retention using excavators, cranes, trucks, concreting etc; and
- (e) crane lift of materials and heavy plant.

3.7 At the primary sites there would be the additional activity of tunnel spoil removal by trucks.

3.8 These activities are relevant to the noise assessment because they are considered to be significant sources of sound with the potential to cause noise effects.

4. ASSESSMENT METHODOLOGY

4.1 The assessment methodology is set out in full in Part 4 of the Noise Report. In summary, the following methodology was used in carrying out the assessment of potential noise impacts associated with the Project:

- (a) Inspections were undertaken of each site.
- (b) At each site the factors which would affect noise from the site to surrounding properties were documented. These factors were used in the acoustic model developed.

- (c) The existing acoustic (noise) environment was measured at each site and categorised. At the three primary sites night-time measurements were also taken.
- (d) Around each site, receiver locations were selected where the noise levels were predicted to be the highest.
- (e) The underlying zoning of each site and the surrounding receiver locations, and the applicable noise rules in those zones, was determined from the relevant district plan and recorded.
- (f) The proposed construction and operational noise controls were developed taking into account the existing noise controls, the necessity to provide protection for residential and business properties and open space against unreasonable noise levels and the most recent New Zealand Acoustic Standards. Instead of numerous noise rules applying at and around each site, one consistent set of controls has been developed for the Project.
- (g) Construction noise was predicted for all sites based on the concept design drawings set out in Part C of the AEE.
- (h) Operational noise was also predicted across the sites where ATFs are proposed to be located based on the same concept design drawings.
- (i) Noise models were used to assess the predicted noise impact at each of the receiver locations. The models take into account noise barriers where they are proposed to be installed, and the three dimensional topography of each site and surrounding area. All noise sources have been modelled as continuous sources.
- (j) Where the noise at a receiver location was predicted to be above the proposed Project Noise Controls, additional mitigation has been proposed where practicable.

4.2 This methodology has been used to identify situations where construction activities may exceed the Project Noise Controls, and to identify potential mitigation options that can be adopted. The Proposed Designation Conditions

include Project Noise Controls which the contractor will endeavour to meet. However, where compliance is not practicable, the contractor would consider alternative management approaches. The Proposed Designation Conditions have been drafted to reflect this approach. Therefore, although construction activities may exceed the Project Noise Controls, if this process is followed, compliance with Watercare's Proposed Conditions would be achieved.

4.3 I now explain how and why this approach has been developed.

5. NOISE CONTROLS AND PROPOSED USE OF MANAGEMENT PLANS

5.1 In this section I explain the rationale for the Project Noise Controls set out in Watercare's Proposed Designation Conditions and the use of a management plan to address construction noise which exceeds the controls.

Project Noise Controls

5.2 As set out in the Noise Report, the full extent of the Project is within the area under the jurisdiction of the Auckland Council. Relevant to the assessment of noise, the Auckland Council District Plan - Auckland City Isthmus and Manukau sections apply to the Project. In addition, the Auckland Council Regional Plan: Coastal applies to the Pump Station 23 and proposed Mangere Pump Station sites as some works at these sites will occur within the coastal marine area.

5.3 There was a range of noise limits and timeframes that could have been applied to the Project. However, I considered it appropriate that a single consistent set of noise limits be applied to the entire Project, as far as practicable.

5.4 I note that the construction works are complex and varied in nature and therefore there is a need for some flexibility to ensure that construction works can be carried out efficiently.

5.5 Taking into account the various existing standards, the need for protection for residential and business properties and open space areas² against unreasonable noise, and the most recent operational and construction noise standards, limits were developed for the construction and operation of the Project that could be imposed as conditions. Taking into account the nature of

² There are no noise limits in the relevant District Plans for noise received in Open Spaces.

the construction, a management approach is also suggested which is capable of addressing situations where the limits cannot be met.

5.6 Section 3 of the Noise Report sets out in full the way in which the proposed Project Noise Controls were derived.

5.7 We considered the following factors when developing the Project Noise Controls:

- (a) The existing noise controls for the sites under consideration.
- (b) The existing ambient sound environment.
- (c) The necessity to provide adequate protection for residential and business properties and open space areas in the vicinity of the proposed sites against unacceptable noise levels generated by construction activities.
- (d) The use of the most recent New Zealand Acoustical Standards for both construction and operational noise. This would facilitate alignment of the recommended noise controls with the future Auckland Council Unitary Plan, which may well be in effect once the works are being constructed.
- (e) The advantage of using the Leq (energy average) noise descriptor for recommended noise limits (and Lmax) to align with the most recent versions of the relevant New Zealand Acoustic Standards, which are: NZS 6801:2008 "Acoustics – Measurement of Environmental Sound," NZS 6802:2008 "Acoustics – Environmental Noise", and NZS 6803:1999 "Acoustics – Construction Noise".
- (f) Ensuring consistency throughout the Project sites insofar as is practicable.

Operational Noise

5.8 The Operational Noise Standards set out below are proposed to apply to the construction sites once the Central Interceptor tunnel and associated facilities are operational.

Table 1: All sites other than Mangere Pump Station

The noise arising from any operational activities undertaken on the designated land, shall not exceed the following noise limits when measured within the boundary of any site zoned as follows:

Residential		
	Time	Noise Limit*
	0700-2200 hours	50 dB L _{Aeq}
	2200-0700 hours	40 dB L _{Aeq} 75 dB L _{Amax}
Business		
	Time	Noise Limit
	At all times	60 dB L _{Aeq}

*Note: These noise limits relate to noise generated by the normal operation of permanent works associated with the Project and do not apply to construction and short term maintenance activities.

- 5.9 The Mangere Pump Station specific criteria are not set out above as the proposed works would occur and be managed to comply with the existing conditions of the Mangere Wastewater Treatment Plant ("**Mangere WWTP**") designation.

Construction Noise

- 5.10 The proposed Project Noise Controls for construction noise are set out below and are based on the "long-term duration" criteria given in Tables 2 and 3 of New Zealand Standard NZS 6803: 1999 Acoustics – Construction Noise ("**NZS 6803: 1999**"). This is appropriate as the construction works at each site will last longer than 20 weeks, which is the definition of "long-term duration" in NZS 6803: 1999. The controls apply at a location one metre from the most-affected façade of dwellings, in accordance with NZS 6803: 1999.
- 5.11 Table 2 from NZS 6803: 1999 is reproduced in full in **Appendix B**. The relevant extracts of Tables 2 and 3 are reproduced below:

Table 2: Residential receivers

Time of Week	Time Period	Long-term duration (dB)	
		L _{Aeq(T)}	L _{Amax}
Weekdays	0630-0730	55	75
	0730-1800	70	85
	1800-2000	65	80
	2000-0630	45	75
Saturdays	0630-0730	45	75
	0730-1800	70	85
	1800-2000	45	75
	2000-0630	45	75
Sunday & public holidays	0630-0730	45	75
	0730-1800	55	85
	1800-2000	45	75
	2000-0630	45	75

Table 3: Industrial and commercial receivers

Time period	dB L _{Aeq(T)}
0730-1800	70
1800-0730	75

(T) means a duration between 15 minutes and 60 minutes, in accordance with NZS6803:1999.

Source: Table 2 NZS 6803: 1999

5.12 In relation to limits of acceptable noise I observe that NZS 6803: 1999 states:

As noise from construction projects is generally of limited duration, people and communities will usually tolerate a higher noise level provided it is no louder than necessary, and occurs within appropriate hours of the day.

5.13 It also states:

Although this may mean that the noise is undesirable, it is not necessarily unreasonable when all the relevant factors are taken into consideration. Construction noise is an inherent part of the progress of society.

5.14 With reference to paragraph 4.2 of my evidence, I note that the Proposed Designation Conditions provide a mechanism for identifying noise non-compliances and implementing alternative management mitigation measures to enable compliance with conditions. I expand on this further below.

6. PREDICTED CONSTRUCTION NOISE LEVELS

6.1 The Project Noise Controls reflect what I consider to be a reasonable level of construction noise, below which no mitigation is required.

6.2 I will now explain the noise levels that I predict site construction works will generate at a number of representative receivers around each construction site. I will also cover potential mitigation options where the predicted noise exceeds the Project Noise Controls.

6.3 It is important to note that where the Project Noise Criteria is predicted to be exceeded, it would only be for a portion of the total duration of works, and therefore any potential effects would be relatively short-term in nature.

Construction Noise Levels

6.4 Mr Cantrell has identified the primary and secondary construction sites and Mr Cooper has explained the range of construction activities being undertaken at the various sites.

6.5 The Noise Report predicted a range of construction noise levels for the selected receiver locations surrounding each of the primary and secondary sites. The predicted values, including mitigation where appropriate, ranged from between 16 to 85 dB L_{Aeq} across all of the sites.

- 6.6 A table of predicted noise levels for each construction site is provided in **Appendix C**. It includes assessed and recommended mitigation options. The receivers included in the table are predicted to receive the highest noise levels from each site, however, they would not necessarily be the only receivers subjected to noise at high levels. Receivers located further from noise sources and/or shielded by intervening houses are predicted to receive noise levels below the levels predicted for the most affected receivers. For this reason I have only included the most affected receivers in **Appendix C**. Where the recommended mitigation measures result in compliance with the Project Noise Controls for the receivers assessed, compliance would also result at all adjacent receivers.
- 6.7 Where my evidence and the table in **Appendix C** refers to duration of effects for specific construction activities e.g. piling, I note that these are estimated durations likely to occur intermittently and have a cumulative duration, as stated in each case, throughout the total construction period.
- 6.8 The general construction noise mitigation measures proposed consist of:
- (a) noise barriers;
 - (b) acoustic enclosures at two of the primary sites;
 - (c) management of the times of use of some noisy plant; and
 - (d) the adoption of alternative methods where available and practicable.
- 6.9 However, at this stage of the Project, the proposed mitigation measures can only be considered indicative, and may be subject to change once equipment and locations are finalised during the detailed design phase and after the proposed construction methodology for each site has been confirmed. The detailed design phase would investigate and assess layout/equipment locations for each site and finalise the necessary mitigation and management measures required to satisfy the requirements of Proposed Designation Conditions CNV.1 and CNV.4.

6.10 This sentiment is supported by Mr Styles:³

It is my view that this is best left to the CNVMP for each site rather than being dealt with at this early stage, as it is very likely that once a contractor is appointed, the site layouts, plant requirements and other operating conditions will change...

6.11 I note that proposed Condition CNV.4 requires the CNVMP to address specific aspects of construction noise and would be developed to include all those matters including all of the items detailed in Annex E E2 of NZS 6803: 1999. Proposed Condition CNV.4 (h) also sets out the approach to be adopted where full compliance cannot be achieved.

6.12 I now discuss construction noise levels for the daytime period (0730-1800 hrs), unless otherwise specified, for each site. I note that no significant evening or night-time shaft excavation work is proposed for the Project. I also note that Proposed Designation Condition CNV.4 addresses all of the proposed mitigation measures specified in the following paragraphs.

6.13 In regard to the sites where basalt would need to be removed, I note that either controlled blasting or rock breaking would be used. The predicted noise levels in this section assume the use of rock breaking. I consider the use of controlled blasting to constitute the adoption of the BPO for reducing the duration of effects, when compared to rock breaking, provided it is carried out in compliance with the blasting noise criteria and managed via communication and consultation with affected parties. I discuss the use of controlled blasting in the next section of my evidence, but the analysis below assumes rock breaking instead.

Western Springs

6.14 The initial shaft excavation is expected to take approximately 4-8 weeks. During this time noise levels are predicted to be in the range of 52-64 dB L_{Aeq} and are predicted to comply with the Project Noise Controls at the identified receivers without any specific mitigation measures required. The effects of this phase of work are considered to be acceptable.

³ Jon Styles, *Central Interceptor Scheme Review of Noise & Vibration Effects* (24 June 2013) at page 8.

- 6.15 Above-ground activities associated with tunnelling during the daytime and evening are predicted to generate noise levels of 52-58 dB L_{Aeq} and are predicted to comply with the daytime Project Noise Controls at the identified receivers without any mitigation. The effects are considered to be acceptable and would have an intermittent duration of 5 years.
- 6.16 In regard to above-ground night-time activities associated with tunnelling, noise levels are predicted to be 52-58 dB L_{Aeq} at the identified receivers prior to mitigation. The predictions exceed the Project Noise Controls by 7-13 decibels. The shaft will therefore need to be enclosed for the tunnelling stage to enable night-time works to be carried out inside the enclosure.
- 6.17 The following general mitigation and management measures were recommended for this site:
- (a) construction of an acoustic enclosure over the shaft site;
 - (b) management of truck movements;
 - (c) management of enclosure door use during the night-time;
 - (d) management of noise intensive works throughout the day; and
 - (e) construction of an acoustic enclosure or barrier around all external plant such as generators, compressors etc that would operate at night-time.
- 6.18 With the mitigation measures outlined above included in predictions, above-ground activities associated with tunnelling are predicted to be 40-45 dB L_{Aeq} at the identified receivers, thus complying with the Project Noise Controls.
- 6.19 Based on the predicted construction noise levels and the recommended mitigation and management measures, the Project Noise Controls can be complied with for all periods of the day and stages of the Project.

Mount Albert War Memorial Reserve

- 6.20 I note that the potential construction noise effects from two site layouts⁴, (the Reserve site and the Car Park site), have been assessed in the Noise Report.
- 6.21 The general details of the Car Park site are set out in the evidence of Mr Cantrell and Mr Cooper. In summary, the site is proposed to be located within the Mount Albert War Memorial Reserve lower car park, immediately adjacent to the original Reserve site. The shafts will be constructed in a similar manner to the Reserve site, therefore noise levels have been predicted using a similar methodology.
- 6.22 It is my understanding that Receiver 2 - 65 Asquith Avenue listed in Table 6 of the Noise Report refers to the dwellings at 65B and 65C Asquith Avenue. These properties are included in **Appendix C**.
- 6.23 Shaft excavation and piling is predicted to exceed the Project Noise Controls, by up to 13 decibels prior to mitigation at 9 and 13A Wairere Avenue, 65B and C Asquith Avenue and the Recreation Centre where rock breakers are used. A comparison of the noise levels without mitigation from the two potential site layouts at this location is provided in **Table 4**.

Table 4: Predicted Construction Noise Levels – without mitigation

Receiver Location		Mount Albert War Memorial Reserve - Reserve Site (dB LAeq)		Mount Albert War Memorial Reserve - Car Park Site (dB LAeq)	
		Excavation	Tunnelling	Excavation	Tunnelling
1	13A Wairere Ave	79	68	77	61
2	65 B & C Asquith Ave (first floor)	77	62	72	55
3	9 Wairere Ave	73	67	80	67
4	22 Selcourt Road	63	49	68	52
5	Recreation Centre	-	-	83	64

⁴ Mt Albert War Memorial Reserve AEE-MAIN-2.1A & 2.2B and Mt Albert War Memorial Reserve Car Park AEE-MAIN-2.1C & 2.2D.

- 6.24 The following mitigation and management measures were proposed:
- (a) construction of a site noise barrier; and/or
 - (b) the adoption of quieter piling methods where possible; and/or
 - (c) the management of noise intensive works throughout the day; and/or
 - (d) moving the control chamber (for the Car Park site).

6.25 In relation to the final point, I note that this has occurred, and the control chamber for the Car Park site has been moved further away from 9 Wairere Avenue.⁵

6.26 The following table sets out the predicted construction noise levels post mitigation.

Table 5: Predicted Construction Noise Levels – with mitigation

Receiver Location		Mount Albert War Memorial Reserve - Reserve Site (dB L _{Aeq})		Mount Albert War Memorial Reserve - Car Park Site (dB L _{Aeq})	
		Excavation	Tunnelling	Excavation	Tunnelling
1	13A Wairere Ave	73	59	68	55
2	65 B & C Asquith Ave (first floor)	77	62	67	51
3	9 Wairere Ave	68	67	68	60
4	22 Selcourt Road	63	49	60	45
5	Recreation Centre	-	-	74	56

6.27 With the mitigation measures outlined above included in predictions, excavation using rock breakers at the Reserve Site is predicted to exceed the Project Noise Controls by 3-7 decibels at 13A Wairere Avenue and 65B and C Asquith Avenue. In addition, access shaft piling is predicted to exceed the criteria by 3 decibels at 65B and C Asquith Avenue. These noise levels have an estimated duration of 1 month. Management mitigation would be required to achieve an acceptable outcome. Alternatively, the effects could be significantly reduced with the use of controlled blasting instead.

⁵

Refer AEE-MAIN-2.1A Issue 2 submitted to Council 13 May 2013.

6.28 In regard to the Car Park site, with the mitigation measures outlined above, the Project Noise Controls are predicted to be met at all residential properties. The construction noise levels are predicted to exceed the Project Noise Controls at the Recreation Centre by 4 decibels. I consider that the predicted level at the Recreation Centre is acceptable, due to the intermittent use of the building, and the short duration of the non-compliance.

6.29 I consider the Car Park site preferable to the Reserve site as it shifts significant noise generating works further away from dwellings, thereby reducing received noise levels appreciably. I consider the Car Park site to have adopted the BPO with regard to ensuring that noise does not exceed a reasonable level.

Lyon Avenue

6.30 Piling and excavation activities are predicted to exceed the criteria by 2-4 decibels at receivers overlooking the drop shaft and diversion chamber. The effects would have an estimated duration of 8 to 10 weeks. Where rock breakers are used to break up the basalt layer, noise is predicted to exceed the criteria by 10 decibels. The effects would have a duration of 2 to 4 weeks and would require management to mitigate effects.

6.31 The receivers adjoining the site are elevated in nature, meaning that conventional mitigation measures such as noise barriers would not be an effective mitigation measure. The management of noise intensive works throughout the day would therefore be required.

6.32 Based on the predicted construction noise levels, the Project Noise Controls would be significantly exceeded when rock breaking is carried out. The duration of effects for rock breaking could be significantly reduced by using controlled blasting to break up the basalt.

Haverstock Road

6.33 Where the basalt layer at this site is broken up via rock breaking, noise levels are predicted to exceed the Project Noise Controls by 4-6 decibels at 96 Haverstock Road and 98-102 Haverstock Road.

6.34 The following general mitigation measures were proposed:

- (a) construction of a noise barrier; and
- (b) adoption of a quieter form of piling.

6.35 With the recommended noise barrier in place, the predicted noise level at 96 Haverstock Road and the ground floor level of 98-102 Haverstock Road would comply with the noise controls. I note that 98-102 Haverstock Road is a 2-storey building, therefore noise barriers would be effective for the ground floor dwellings only. As such, rock breaking would be non-compliant by 6 decibels on the upper level at this location. Therefore, the management of residual noise effects would be required. The effects from rock breaking would have an estimated duration of 2 weeks but could be significantly reduced where controlled blasting is used instead.

6.36 Based on the predicted construction noise levels, the Project Noise Controls would be significantly exceeded where rock breaking is carried out. The duration of effects for rock breaking could be significantly reduced by using controlled blasting to break up the basalt.

Walmsley Park

6.37 Significant exceedances of the Project Noise Controls are predicted for this site, after mitigation, where rock breaking and vibratory sheet piling are used.

6.38 Vibratory sheet piling is predicted to exceed the criteria by 4-8 decibels at 7 and 3 O'Donnell Avenue. Rock breaking is also predicted to exceed the criteria by 7-12 decibels respectively at these two locations, prior to mitigation.

6.39 A quieter method of piling could be adopted if possible or, where this option is not available, noise effects would be managed through communication with affected parties. The effects would have an estimated duration of 2 weeks.

6.40 In regard to rock-breaking, construction of a site noise barrier would reduce the predicted noise level exceedance at 7 and 3 O'Donnell Avenue to 3-7 decibels. The residual noise effects could be managed through communication with affected parties. The effects would have an estimated duration 4 weeks but could be significantly reduced where controlled blasting is used instead.

May Road

- 6.41 Daytime shaft excavation noise levels are predicted to exceed the Project Noise Controls by 7-10 decibels (depending on whether rock breaking is used) for 53A Marion Avenue prior to mitigation. There will be no evening or night-time shaft excavation, but mitigation will be required during the daytime.
- 6.42 Above-ground activities associated with tunnelling are predicted to generate noise levels of 59-65 dB L_{Aeq} before mitigation. The predictions exceed the Project Noise Controls for the night-time by 14-20 decibels. Once excavated, the shaft will be enclosed for the tunnelling stage to enable night-time works to occur inside the enclosure. With this mitigation in place, above ground activities associated with tunnelling are predicted to comply with the Project Noise Controls at the identified receivers.
- 6.43 The following general mitigation and management measures were recommended for this site:
- (a) construction of a noise barrier along western site boundary;
 - (b) construction of an acoustic enclosure over the shaft site;
 - (c) management of truck movements;
 - (d) management of enclosure door use during the night-time;
 - (e) management of noise intensive works throughout the day; and
 - (f) construction of acoustic enclosure or barrier around all external plant such as generators, compressors etc that would operate at night-time.
- 6.44 Including the mitigation measures outlined, daytime excavation works are predicted to comply with the Project Noise Controls at all identified receiver locations with the exception of 53A Marion Avenue, where a minor 2 decibel exceedance of the Project Noise Controls is predicted, after mitigation, during rock breaking for shaft excavation. The effects are considered to be minor and would have a duration of 2 months.

- 6.45 With the mitigation measures outlined above included in predictions, above-ground night-time activities associated with tunnelling are predicted to range between 39-43 dB L_{Aeq} at the identified receivers. The predicted levels would therefore comply with the Project Noise Controls and any effects would be minor.
- 6.46 Based on the predicted levels and the recommended mitigation and management measures, the Project Noise Controls can be complied with for all periods of the day and stages of the Project with the exception of a minor non-compliance during rock breaking for shaft excavation.

Keith Hay Park

- 6.47 Site demolition works, excavation and piling are predicted to exceed the criteria by 9-15 decibels at 18-19 Gregory Place and 47 Arundel Street.
- 6.48 I note that as the dwellings on the identified properties are of 2-storey construction, noise barriers would provide effective screening for the ground floor only. Therefore, in addition to the proposed noise barrier, noise effects will require management to mitigate effects on affected parties. The duration of effects is estimated to be 4 to 6 weeks.
- 6.49 In summary, this site is predicted to significantly exceed the Project Noise Controls and would require mitigation and management to achieve an acceptable outcome.

Pump Station 23

- 6.50 The Noise Report concluded that demolition of the existing pump station would not comply with the Project Noise Controls, only to a marginal extent at 25 Frederick Street, and by 6-8 decibels for 33A Frederick Street and 6/41 Frederick Street. The demolition of the pump station would be of short-term duration. Predicted noise levels from piling and excavation would not comply by 3 decibels at 33A Frederick Street and 6/41 Frederick Street and would have a duration of 4-6 weeks.
- 6.51 Other significant noise sources would be the movement of heavy vehicles on the site access road, where a 3 decibel exceedance for dwellings adjacent to the access road is predicted. The effects would last for the duration of the

Project. However these would be intermittent in nature and would only occur during normal construction hours. I therefore consider the effect from vehicle movements to be acceptable.

6.52 I observe that noise barriers would not be an effective mitigation measure as the surrounding receivers are elevated above the site. Therefore, the management of noise intensive works throughout the day would be required.

6.53 Noise effects are considered to be significant during shaft excavation at this site, particularly where vibratory sheet piling is adopted, and would therefore require management through effective communication with affected parties prior to starting.

6.54 It is noted that this site is designated and an expanded footprint is sought.

Kiwi Esplanade

6.55 The noise levels are predicted to comply with the Project Noise Controls without the need for any mitigation measures. I therefore consider the effects from construction noise for the duration of the Project to be reasonable for the sensitive receivers adjacent to this site.

Motions Road, and Western Springs Depot

6.56 The noise levels at these two sites are predicted to comply with the Project Noise Controls without the need for any mitigation measures. I therefore consider the effects from construction noise for the duration of the Project to be reasonable for the sensitive receivers adjacent to these sites.

Rawalpindi Reserve

6.57 Piling and excavation work is predicted to exceed the Project Noise Controls prior to mitigation by 6 decibels at 19 Rawalpindi Avenue.

6.58 The Noise Report proposed the construction of a noise barrier around the construction site as indicated. With the recommended mitigation in place, construction noise levels are predicted to comply with the Project Noise Controls and the effects are therefore considered to be reasonable for the dwellings adjacent to the site.

Norgrove Avenue

- 6.59 The predicted construction noise levels for this site have been revised in response to a Section 92 request for information dated 2 October 2012.
- 6.60 Piling and site excavation are predicted to exceed the Project Noise Controls by 9 decibels at 16 Norgrove Avenue and 27 Verona Avenue, prior to noise mitigation. A marginal exceedance of 3 decibels is predicted for 23 Verona Avenue from piling, prior to mitigation. The effects from piling and excavation would have a duration of 4-6 weeks.
- 6.61 Other significant noise sources would be the movement of heavy vehicles on the site, with predictions indicating a 5 decibel exceedance for 27 Verona Avenue. I note that this dwelling is of 2-storey construction.
- 6.62 The following general mitigation and management measures are proposed:
- (a) construction of site noise barrier; and
 - (b) management of noise effects through communication with potentially affected residents.
- 6.63 With a noise barrier in place, predicted noise levels for 23 Norgrove Avenue would comply with the Project Noise Controls. A 3 decibel excess is predicted for 16 Norgrove post-mitigation, which is considered minor.
- 6.64 In regard to 27 Verona Avenue I note that a noise barrier would not be effective in reducing noise to the upper floor of this dwelling. Therefore the effects from piling could potentially be significant for 4-6 weeks and would require management through the CNVMP. The effects from trucks entering and exiting the site, although predicted to be non-compliant, are considered to be reasonable given their intermittent nature and occurrence during normal construction hours only.
- 6.65 In summary, noise effects are considered to be significant at one location during shaft excavation and would require management for the duration of the excavation phase. Noise effects are considered to be acceptable for all remaining dwellings, where a site noise barrier is constructed.

Pump Station 25

- 6.66 The demolition of the existing pump station is predicted to marginally exceed the Project Noise Controls by 1-2 decibels for adjacent receivers on Taylor Close and Miranda Close. Trenching works occurring in close proximity to 32A Miranda Street would exceed the criteria by 9 decibels.
- 6.67 Due to the characteristics of site topography, I note that a site noise barrier of practical height would not provide effective noise screening in this instance.
- 6.68 The following general mitigation and management measures were proposed in the Noise Report:
- (a) mobile screening around trenching works in close proximity to 32A Miranda Street and other similarly located dwellings; or
 - (b) management of trenching noise effects through communication with potentially affected residents.
- 6.69 I consider the predicted non-compliance during demolition to be minor and of little appreciable significance. To minimise any effects, surrounding receivers would be notified in advance of the works.
- 6.70 In regard to non-compliant trenching works I note that the process of trenching is not static, and noise exposure would be of short-term duration at any one location. Where affected parties are notified in advance, I consider any noise effects could be successfully managed and the effects would last for less than a day. I therefore do not consider the use of mobile screening necessary in this instance.
- 6.71 Based on the predicted construction noise levels and proposed management mitigation, the Project Noise Controls can generally be complied with, with the exception of trenching works. Due to the short-term nature of exceedances, and with management through the CNVMP, noise effects are considered to be acceptable for all receivers.

Miranda Reserve

- 6.72 Piling and excavation work is predicted to exceed the Project Noise Controls prior to mitigation by 4 decibels at 337 Blockhouse Bay Road
- 6.73 The Noise Report proposed the construction of a noise barrier around the construction site as indicated. With the recommended mitigation in place, construction noise levels are predicted to comply with the Project Noise Controls and the effects are therefore considered to be reasonable for the dwellings adjacent to this site.

Whitney Street

- 6.74 Piling and excavation is predicted to marginally exceed the Project Noise Controls by 1-3 decibels for 115, 124 and 130 Whitney Street.
- 6.75 Trenching is predicted to marginally exceed the criteria by 2 decibels at 56 Margate Road. The effects from trenching would have a duration of less than 1 day.
- 6.76 The following general mitigation and management measures have been proposed:
- (a) construction of a noise barrier; and
 - (b) management of noise effects from trenching and piling through communication with potentially affected residents.
- 6.77 With the mitigation measures outlined above included in predictions, minor exceedances of 1-3 decibels would result at the upper floor of the identified receivers. The effects from piling and excavation would have a duration of 4-6 weeks.
- 6.78 The Project Noise Controls can be complied with in the main with the exception of small non-compliances which are considered to be minor and therefore of little appreciable significance. To minimise any effects, surrounding receivers should be notified in advance of the works.

Dundale Avenue

- 6.79 Piling and excavation work is predicted to exceed the Project Noise Controls prior to mitigation by 3 decibels at 66 C and D Dundale Avenue
- 6.80 The Noise Report proposed the construction of a noise barrier around each of the construction sites as indicated. With the recommended mitigation in place, construction noise levels are predicted to comply with the Project Noise Controls and the effects are therefore considered to be reasonable for adjacent dwellings.

Haycock Avenue

- 6.81 The demolition of existing structures on-site is predicted to exceed the Project Noise Controls by 2-15 decibels at all the identified receiver locations unless mitigated. Piling and excavation is predicted to exceed the noise controls by 2-10 decibels at 2 and 6 Haycock Avenue unless mitigated. If the Tunnel Boring Machine ("TBM") is retrieved from the Central Interceptor tunnel at this site using a large crawler crane, noise levels are predicted to exceed the noise controls by 7 decibels at 2 and 6 Haycock Avenue unless mitigated. Trenching is predicted to exceed by 3 decibels at 83B White Swan Road where it occurs outside the site boundary.
- 6.82 The following general mitigation and management measures were proposed:
- (a) construction of a site noise barrier;
 - (b) use of mobile noise screening for trenching; and
 - (c) the management of noise intensive works throughout the day.
- 6.83 With the recommended noise barrier in place, site excavation works are predicted to comply with the Project Noise Controls at all identified receiver locations.
- 6.84 Site demolition is predicted to exceed the noise criteria by 2-6 decibels at 1, 2 and 6 Haycock Avenue after mitigation. The non-compliance would have an estimated duration of only 1 day and is therefore considered to be acceptable.

- 6.85 A marginal 2 decibel exceedance is predicted at 2 and 6 Haycock Avenue after mitigation, where a large crawler crane is used to extract the TBM from the Central Interceptor tunnel. Again, the non-compliance would have an estimated duration of only 1 day and is considered to be acceptable.
- 6.86 In regard to non-compliant trenching works predicted at 83B White Swan Road, I note that the process of trenching is not static, and noise exposure would be of short-term duration in any one location. With advance communication with affected parties, I consider any noise effects to be acceptable and of limited duration.
- 6.87 Based on the predicted construction noise levels and recommended mitigation measures, the Project Noise Controls would be exceeded on occasion as detailed above, however, it is considered that with management mitigation any noise effects would be acceptable.

Summary

- 6.88 The construction noise levels predicted to be received at dwellings and other noise-sensitive receivers in the vicinity of construction activity at the various sites, range from readily compliant without the need for mitigation, to compliance with Project Noise Controls with implementation of mitigation measures, to minor non-compliances despite the mitigation measures and, in a few instances, significant exceedances. The duration of exceedances are considered to be short term and would be managed to comply with the Proposed Designation Conditions.

Blasting Noise

- 6.89 The assessment above is based on an assumption that rock-breaking will be used to excavate the shafts. However, controlled blasting could be used at the following sites as an alternative to rock-breaking:
- (a) Western Springs
 - (b) Mount Albert War Memorial Reserve
 - (c) Lyon Avenue

- (d) Haverstock Road
- (e) Walmsley Park
- (f) May Road
- (g) Kiwi Esplanade
- (h) Motions Road
- (i) Western Springs Depot

6.90 With regard to the process of blasting I observe that this involves the controlled detonation of a number of small explosive charges inserted into pre-drilled holes in the ground. Upon detonation, instantaneous noise levels would exceed the normal Project Noise Controls by a significant margin. The construction noise standard NZS 6803: 1999 recognises this and sets specific controls for blasting noise that are different to the controls set for other types of construction work.

6.91 I note that a noise limit of 120 dB L_{Cpeak} was recommended in the Noise Report in relation to controlled blasting activity.

6.92 Refer to paragraph 9.17 for further discussion in relation to blasting noise criteria.

Tunnelling Noise

6.93 The Noise Report acknowledged the complexity in predicting re-radiated noise from tunnelling due to the multifaceted interaction of variables involved, including building junctions, building material variance and ground type, amongst others. The Noise Report noted that:⁶

In the rock expected to be encountered during tunnelling, the TBM will generally produce low level vibration that would be expected to attenuate quickly and be below the perception threshold at the ground surface.

⁶ Noise Report at 4.7.

6.94 Based on the anticipated tunnelling depth and rate of extraction of approximately 12 metres per day, the TBM progress is considered to be relatively quick and would generally pass under each dwelling within a day or two. I therefore conclude that re-radiated noise effects from tunnelling would be no more than minor.

7. OPERATIONAL NOISE LEVELS

Operational Noise Controls

7.1 The ATFs are the only items of equipment outside the Mangere WWTP which would generate noise of any significance. As such, no other items of equipment are discussed here.

7.2 I consider the Project Noise Controls developed for the operation phase of the Project, and set out in Proposed Designation Condition ON.1, to be reasonable and to provide an acceptable level of amenity protection to properties surrounding the sites where ATFs would be located.

7.3 I will now discuss the predicted noise levels at receivers located around a number of sites where ATFs will be located. Included in the discussion will be potential mitigation options to ensure compliance with the Project Noise Controls.

Predicted operational noise levels

7.4 In regard to operational noise, the Noise Report predicted a range of 30 to 40 dB L_{Aeq} at receiver locations across the sites where ATFs are proposed to be located.

7.5 The table in **Appendix D** sets out the predicted noise levels from the Noise Report for the ATFs at identified receiver locations. It should be noted that the predicted levels and recommended mitigation measures are based on concept designs only and would be subject to conventional noise control engineering procedures during the detailed design phase to ensure that the resultant noise levels would comply with the Project Noise Controls.

- 7.6 The Project Noise Controls could be complied with at all receiver locations based on the following general mitigation measures:
- (a) air treatment buildings to be acoustically rated;
 - (b) control of reverberant sound inside buildings using absorptive surfaces; and
 - (c) acoustic silencing of exhausts or vents.
- 7.7 Proposed Designation Condition ON.1 provides for the proposed mitigation measures outlined above, or comparable measures to be implemented. This will ensure that operational noise effects are reduced to compliant levels.

8. RESPONSE TO SUBMISSIONS

- 8.1 I have read the submissions pertaining to noise issues. Of the submissions received, twenty-five address noise as an issue of concern. Of these, six submissions⁷ refer to noise in a general manner. These general issues are addressed in the body of my evidence and the Noise Report and will not be repeated here.
- 8.2 Of the eighteen remaining submissions, ten⁸ share common issues and I comment on these matters below. I also comment on specific matters raised in the other eight⁹ submissions below.

Mount Albert War Memorial Reserve

- 8.3 Table 6 below lists all submissions received on the original Reserve site. I have noted the specific construction noise levels predicted for each submitter's site for the noisiest phase of construction (excavation by rock breaking). I have also noted the comparable values for the Car Park site in the adjacent column.

⁷ St. Lukes Garden Apartments Progressive Society Incorporated; St. Lukes Garden Apartments Body Corporate 346086; Craig; Jotti and Eades; Mellor; France.

⁸ Curnow and Hume; Burnett; Colloff; Boyd; Boyle; Sannum; Stark; Archer; Laraman; Puertollano.

⁹ Community of Refuge Trust; Institute of Environmental Science & Research; Plant & Food Research; Kerridge and Kedge; McAlwee; Wei and Zhang; Whitehead; Foodstuffs Limited.

Table 6: Excavation (rock breaking) Noise Levels predicted for submitters at the Mount Albert War Memorial Reserve site and Car Park site – with mitigation

Submitter	Submission address	Reserve Site Noise Limit: 70 (dB L_{Aeq})	Car Park Site Noise Limit: 70 (dB L_{Aeq})
Burnett	1 Rossgrove Terrace	55	52
Laraman	3/61 Asquith Avenue	61	58
Sannum	63 Asquith Avenue	58	54
Kerridge & Kedge	65 Asquith Avenue	71	60
McAlwee	65C Asquith Avenue	77	67
Wei & Zhang	65B Asquith Avenue	77	67
Colloff	67 Asquith Avenue	59	55
CORT	9 Wairere Avenue	68	68
Laural France	13 Wairere Avenue	57	51
Boyd	15 Wairere Avenue	73	59
Nicola Craig	16 Wairere Avenue	58	55
Innes Mellor	17 Wairere Avenue	73	58
Jotti & Eades	18 Wairere Avenue	59	55
Archer	19 Wairere Avenue	67	58
Stark	20 Wairere Avenue	56	52
Boyle	23 Wairere Avenue	68	62
Curmow & Hume	25 Wairere Avenue	61	48

8.4 As can be seen in Table 6, noise levels from rock breaking are predicted to be significantly louder, and non-compliant with the Project Noise Controls after mitigation, at a number of submitters' properties for the Reserve site. For the Car Park site, noise levels are predicted to be compliant at all submitter locations with the recommended mitigation measures in place.

8.5 I will now discuss the general concerns raised at this site followed by specifics.

General concerns

Noise barrier

- 8.6 A number of submissions expressed concern about the adequacy of the proposed 2 metre high noise barrier and seek a barrier of greater height than that proposed and/or that it be constructed from a different material.
- 8.7 The Noise Report recommended a two metre high noise barrier to reduce construction noise to levels compliant with the Project Noise Controls. Whilst I recognise that a noise barrier of greater height would increase the level of protection provided to all ground based receivers, it would provide less of an improvement for receivers located on the upper level of a multi-storey building. Therefore, I do not consider a barrier of greater height to be the adoption of the BPO in terms of reducing noise to reasonable levels *for all receivers*. I consider the Car Park site to be the BPO in terms of reducing noise based on the proposed site location and noise barrier extent, including the barrier along the access road boundary.
- 8.8 I note that the final noise barrier height will be given due consideration during the detailed design phase of the Project. Where a barrier of a greater height is considered to be required to mitigate against potential noise effects this would be proposed.
- 8.9 Concerning the issue of the material with which the noise barrier would be made from, in my opinion a standard stone gabion wall as sought would not provide sufficient performance to effectively mitigate construction noise to adjacent dwellings. The way in which this type of wall is constructed results in significant air gaps, creating pathways through which sound can pass. The performance of this type of wall is significantly less than a timber wall, as proposed. Timber noise barriers represent standard industry practice and are routinely used to provide noise attenuation.

Double glazing and mechanical ventilation

- 8.10 A number of submissions requested the installation of double glazing and mechanical ventilation to mitigate construction noise. Traditionally, these types of mitigation measures are considered for projects where long-term operational noise is assessed as having a more than minor effect. As construction noise is

variable in nature and of relatively short duration compared to operation noise, alternative measures may be more practicable. Whether these or other measures are required could be considered during the detailed design phase of the Project once the construction methodology is finalised. At this stage, however, it is considered unnecessary for the Car Park site as the modelling predicts compliance with the limits with the current mitigation proposed.

Construction duration, noise levels and effects

- 8.11 A number of submissions expressed concern about the hours of construction, duration of works, work potentially carried out outside normal construction hours, and the effects of noise on people in the Mount Albert War Memorial Reserve.
- 8.12 The estimated duration of the construction activities at this site would be 12 – 18 months, but spread over several years. The initial shaft excavations and connections would occur for an estimated duration of 3.5 – 5 months during the daytime. This period is likely to involve the greatest potential for noise effects due to the activities involved. The remainder of the works would consist of servicing the shaft, including shaft muck-out and truck movements and would generate significantly lower levels of noise on an intermittent basis.
- 8.13 Regarding the issue of construction work outside normal construction hours, including night-time work, I refer to the anticipated construction arrangements detailed in paragraphs 3.4 and 3.5 of my evidence.
- 8.14 The proposed Project Noise Controls are designed to generally protect the whole population, including both children and adults. I further note that in general, noise limits are designed to protect acoustic amenity, but in the case of construction noise the need for protection is balanced against the significant benefits to the community enabled by the Project. Therefore, the limits for construction noise are less stringent than for normal activity, recognising that this activity is finite in duration.
- 8.15 As a general comment, it is better for the noise effects of this construction activity to be evident on the Reserve land rather than on residential land and buildings, as the potential impact on people in a reserve is less. Exposure to such noise can be voluntarily avoided in a reserve whereas on residential land

and buildings this is generally not the case. A level of 75 dB L_{Aeq} is generally predicted in the Mount Albert War Memorial Reserve 20 metres from the site boundary with line of site to noise sources. This level of noise is considered to be acceptable in the context of the Mount Albert War Memorial Reserve setting for the reasons described above.

Monitoring of Ambient and Construction Noise Levels

- 8.16 The monitoring of noise prior to and during construction at individual properties was requested by a number of submitters.
- 8.17 In regard to pre-construction monitoring, I note from the Noise Report that an ambient level of 47 dB L_{Aeq} was measured on the Mount Albert War Memorial Reserve during the daytime period. I consider this level of ambient noise to be representative of the general acoustic amenity for all adjacent properties. On this basis, I consider that additional pre-construction monitoring is not required for this site.
- 8.18 Generally, noise limits are not determined based on a specific noise level at a specific location, but in relation to the general ambient noise environment of the area under consideration. Therefore, some variation of ambient noise level for different dwellings will not generally affect a specified noise limit.
- 8.19 In regard to monitoring construction noise levels at individual dwellings, I consider that the Project CNVMP (refer Proposed Designation Conditions CNV.1-CNV.7) sufficiently outlines the methodology for identifying suitable noise monitoring locations representative of all receivers locations.

Advance Notification of Construction Works

- 8.20 The intention is that the Project's CMP will contain specific community liaison measures covering advance notice of construction works (refer Proposed Designation Condition CM.2 (in particular CM.2(g))). I consider this is adequate to address the submitters' request.

Acoustic Enclosure over Shafts

- 8.21 A number of submissions have requested the construction of enclosures over all shafts on this site. Due to the relatively small size of the shafts proposed at this site, I do not consider this to be a practical mitigation measure as it would add complexity to the Project and would delay completion of excavation works considerably due to the additional physical constraint to work around the shaft.

Specific Concerns of Submissions for both Mount Albert War Memorial Reserve Site options

Community of Refuge Trust

- 8.22 The submission of the CORT, which owns 9 Wairere Avenue, Mount Albert, refers to noise generally and expresses concern about the hours of construction and duration of works. I observe that this property is one of the closest noise sensitive receivers to the site, regardless of which option is selected.
- 8.23 In relation to the issues of construction hours and duration of work, these have been addressed in my response to general submission concerns above. With the exception of this point, I address all of CORT's issues below.

Noise barrier

- 8.24 I have predicted a noise level of 67 dB L_{Aeq} , from truck movements along the access road, which complies with the Project Noise Controls. As truck movements are considered to be the controlling source of sound along the south-eastern boundary, and would be intermittent in nature, the predicted noise level indicates that a noise barrier is not required along the south-eastern boundary.
- 8.25 Nevertheless, I understand that Watercare now proposes to construct a noise barrier along the south-eastern boundary of the submitter's property to provide a greater degree of protection against construction noise than would be achieved with the Project Noise Controls. The specific details of the barrier would be finalised in the detailed design phase of the Project.

Proximity of noise sources to property boundary

- 8.26 I note that any activities that occur close to residential boundaries would be of short-term duration at any one location. Irrespective of this, before any work is carried out the provisions of Proposed Designation Condition CNV.4, including in particular CNV.4(f), would enable sensitive locations to be identified, appropriate mitigation and management measures to be developed and communicated with affected parties prior to work commencing.
- 8.27 I note that as part of the Car Park site assessment, a noise barrier was proposed along the south-eastern boundary of the submitter's property. I also note that Watercare has moved the control chamber further away from the property boundary. I consider these measures to have adopted the BPO for controlling noise to reasonable levels.
- 8.28 I consider that all of the concerns raised by the submitter can be addressed through the Proposed Designation Conditions including the CNVMP and CMP to ensure implementation of appropriate mitigation and management measures. This conclusion applies to both options.

Peter Kerridge and Sally Kedge

- 8.29 The submission of Peter Kerridge and Sally Kedge, of 65 Asquith Avenue, expresses general concerns about the sustained impact from construction works and tunnelling, noise from jack hammers, piling and drilling rigs and in relation to the hours of construction. The submission opposes night-time and weekend works and expresses concern over the adequacy of the proposed two metre high noise barrier.
- 8.30 The submission requests the monitoring of construction noise on the property and notification in relation to predicted times of excessive noise. It further requests the installation of double glazing, the installation of taller, more effective noise barriers, and additional noise screening to the property if noise levels are deemed to be excessive. The submission also requests that construction processes reduce unnecessary noise and disruption as much as possible.

8.31 Most of the submitter's concerns have been addressed in my response to general submission concerns above. The following addresses their specific issues.

8.32 I note that, for both options, construction noise is predicted to comply with the Project Noise Controls at this location. However, generally, in circumstances where the proposed mitigation does not result in compliant noise levels, the Proposed Designation Conditions and the CNVMP provisions allow for the development of alternative management strategies to achieve an acceptable outcome. This includes a number of options including timing of noisy works to coincide with residents' being away from home and the temporary relocation of residents in some instances. While it is not expected that the noise controls will be exceeded at this dwelling, there are options available in the event that compliance cannot be achieved.

8.33 Concerning the request that construction processes reduce unnecessary noise and disruption, I note that Watercare has a duty to adopt the BPO to ensure that noise does not exceed a reasonable level. I also note that the CNVMP required by the Proposed Designation Conditions will contain specific measures to avoid, remedy or mitigate unnecessary noise at the site.

Pip, Tony and Alexandra McAlwee and Rosy Wei and George & Jack Zhang

8.34 The submissions of Pip, Tony and Alexandra McAlwee of 65C Asquith Avenue, and George & Jack Zhang and Rosy Wei of 65B Asquith Avenue, express concerns as to whether the noise impact assessment adequately assesses noise from shaft excavation and trenching; queries why pre-construction ambient noise measurements were not carried out on their property; and expresses concerns over the adequacy of the two metre high noise barrier.

8.35 The submissions request the following:

- (a) No vibratory sheet piling.
- (b) Adoption of World Health Organisation ("**WHO**") noise limits for re-radiated noise associated with tunnelling.
- (c) No Sunday work and work on Saturday to end at 2 pm.

- (d) No entry to site before 6.45 am Monday – Saturday.
- (e) No night-time works or relocation of family if night-time works are consented.
- (f) Preparation of a Site Specific Noise Management Plan where construction noise non-compliance is predicted.
- (g) Affected residents be given 7 days notice of any non-compliant construction work.
- (h) Noise barrier built to a minimum height of 3 metres and constructed from stone (gabion noise wall).
- (i) Installation of mechanical ventilation.
- (j) Erecting enclosed sheds over each of the shafts.
- (k) The monitoring of noise levels one metre from the façade of the dwelling prior to start of construction works in addition to permanent monitoring during construction.

8.36 The majority of the submitters' concerns are addressed in my evidence in response to general submission concerns set out above. The following addresses their specific concerns.

Submitter specific concerns

8.37 In relation to the issue of whether the noise impact assessment adequately assesses noise from three shafts, I note that the temporary shaft (for the construction of Link Sewer 2) and access shafts shown in drawing **AEE-Main-2.2** at page 38 of the Hearing Drawing Set are adjacent to each other. The equipment locations used in the noise modelling are representative of either of the two locations, based on their relative distances from these dwellings, therefore the level of noise would be similar. It is my understanding that the shafts will be initially constructed in series but with some overlapping of discrete operations. I can confirm that the noise impact assessment adequately assesses noise from the construction programme of the main tunnel and link sewer shafts based on the preliminary concept designs.

- 8.38 The submitters' have requested to apply the WHO internal noise criteria of 35 dB $L_{Aeq(16h)}$ daytime and 30 dB $L_{Aeq(8h)}$ night-time to tunnelling activities. I note that the Waterview Project Board of Inquiry decision noted that "*vibration from tunnelling can cause structure-borne noise, sometimes called re-radiated noise*"¹⁰ and that the WHO criteria were consequently adopted in the decision.
- 8.39 However, the tunnelling works involved in the Project are considered to be substantially different to the Waterview Project in that the depth of the main tunnel is considerably greater and ranges from 22 to 110 metres compared to near the surface for Waterview. The depth of the main tunnel under the Mount Albert War Memorial Reserve is 53 metres, and the depth of Link Sewer 2 under Mount Albert War Memorial Reserve is similarly located. The Central Interceptor tunnel is also of smaller diameter than Waterview, significantly reducing the cutting area of the TBM. In addition, the ground types anticipated to be encountered during Project tunnelling is soft clays or East Coast Bays Formation. I understand that the TBM would generally produce low level vibrations in these circumstances that would be expected to attenuate quickly and be below the threshold of perception at surface level.¹¹ Further, the TBM progresses relatively quickly and would generally pass under each dwelling within a day or two.
- 8.40 Based on the above, in my opinion re-radiated noise would be of no appreciable significance. Therefore, I do not see any need to adopt such criteria in this instance.
- 8.41 The submitter seeks to limit construction hours on Saturday to 7.30 am to 2 pm. However, Saturday is now recognised by NZS 6803: 1999 to be a normal working day and I note that the Project Noise Controls reflect this. Enabling work to occur on Saturdays may also allow the overall duration of works to be shorter.
- 8.42 Concerning the submitters' request for a Site Specific Noise Management Plan where non-compliances are predicted, I note in the Proposed Designation Conditions that the CNVMP will identify activities and locations that would

¹⁰ Draft Report and Decision of the Board of Inquiry into the New Zealand Transport Agency Waterview Connection Proposal, at [746].

¹¹ Refer Tonkin & Taylor 2012 Vibration Assessment for Main Tunnels and Link Sewers.

require the design of noise mitigation where the Project Noise Controls are predicted to be exceeded. I consider this to be satisfactory as the CNVMP will include consideration of the particular circumstances of each site.

Keith Hay Park

8.43 In responding to the two submissions for this site, I note the following submitter-specific noise levels are predicted post-mitigation:

Table 7: Excavation Noise Levels predicted for Submitters at Keith Hay Park site – post mitigation

Submitter	Submission address	Construction Noise Level (dB L_{Aeq})
Whitehead	18 Gregory Place	79
Puertollano	47A Arundel Street	80

8.44 The predicted construction noise levels during excavation given in the table are non-compliant with the Project Noise Controls.

8.45 The submissions from Mr and Mrs Whitehead and Mr and Mrs Puertollano express general concern about noise from the Project and the hours of construction and duration of works at the Keith Hay Park site.

8.46 The submission from Mr and Mrs Whitehead seeks a reduction in working hours from Monday to Friday 7.30am – 5.30pm; Saturday 8.00am – 4.00pm and no work on Sundays or public holidays. I note that a reduction in working hours is also sought by Mr and Mrs Puertollano - Monday to Friday 7.30am – 5.30pm; no work Saturdays, Sundays and public holidays.

8.47 Both submissions seek the installation of double glazing to windows facing the construction site.

8.48 These concerns have been addressed in part in the response to general matters outlined above, with further specific comment provided below.

8.49 Watercare has met and corresponded with Mr and Mrs Whitehead on several occasions,¹² including one that I attended.¹³ During the meeting I inspected the house and noted details of its construction in order to provide advice on potential mitigation options. I understand that Watercare is consulting with the affected party to reach a mutually acceptable outcome.

8.50 I consider that all of the concerns raised by the submitters can be addressed through the Proposed Designation Conditions including the CNVMP to ensure implementation of appropriate mitigation and management measures.

Haverstock Road

8.51 In responding to submissions for this site, I have predicted the following submitter-specific noise levels:

Table 8: Excavation Noise Levels Predicted for submitters at Haverstock Road

Submitter	Submission address	Construction Noise Level (dB L_{Aeq})
Institute of Environmental Science & Research ("IESR")	18 Hampstead Road	65
New Zealand Institute for Plant and Food Research ("PFR")	118-120 Mt Albert Road	67

8.52 The predicted construction noise levels given in the table comply with the Project Noise Controls.

8.53 The submissions of the IESR of 18 Hampstead Road, and PFR of 118 - 120 Mount Albert Road, refer to the potential for noise impacts on the function and operation of sensitive laboratories located within the site. The submissions request a site specific assessment of environmental effects be carried out.

8.54 Based on a predicted incident noise level of 65 dB L_{Aeq} for IESR and 67 dB L_{Aeq} for PFR on the façade of the main building identified on each site, I conclude that internal noise levels would be sufficiently attenuated as to have

¹² Meeting 6 November 2012, correspondence September-October 2013.

¹³ Meeting held at 18 Gregory Place, Hillsborough 29 May 2013.

no appreciable impact on function and operation of sensitive laboratories located within the site.

- 8.55 I therefore consider that a receiver specific assessment of noise effects is not warranted and that the CNVMP would adequately deal with the submitter's concerns.

May Road

- 8.56 Foodstuffs (Auckland) Limited lodged a submission raising noise concerns in relation to the May Road site. The submission:

- (a) expresses concern in relation to adverse impacts of construction noise on occupants of offices and distribution centre buildings associated with the company;
- (b) claims that insufficient consideration has been given to mitigating noise effects resulting from the site on surrounding commercial properties;
- (c) notes two inconsistencies between the noise impact assessment and other reports forming the AEE documentation, notably relating to the number of heavy vehicle movements per day and the estimate for the duration of construction; and
- (d) suggests that noise effects should be assessed against the relevant controls in the district plan, rather than the Construction Noise Standard used in the Project Noise Controls, due to the estimated duration of works.

- 8.57 Concerning the first issue of adverse impacts from site construction noise and the adequacy of the assessment of effects, I note the following:

- (a) The commercial receiver assessed in Table 10 of the Noise Report is representative of the worst case noise level that would be received on the Foodstuffs site for locations where people carry out their work. At this receiver a level of 63 dB L_{Aeq} was predicted for general construction activities. I also carried out an additional noise prediction to confirm the potential noise level from blast hole preparatory work.

The results indicate that a level of 68 dB L_{Aeq} would be received during rock breaking and drilling work. These sources will be the loudest short-term noise sources which would operate on-site. The predicted levels comply with the Project Noise Controls.

- (b) I have carried out additional noise predictions at the façades of the office building located at 59 Roma Road, as well as the Foodstuffs loading bay located to the north-west of the proposed construction site. I predict a level of noise from construction activities of 65 dB L_{Aeq} at the façade of 59 Roma Road and a level of 64 dB L_{Aeq} at the Foodstuffs loading bay. I note that these predicted levels also comply with the Project Noise Controls.
- (c) Assuming a reduction in noise level of 15 decibels through an open window, I estimate an internal noise level resulting from site construction works of no more than 49 - 50 dB L_{Aeq} for these commercial receivers. It is my opinion that this level of internal noise is acceptable, given that the receiver is on land zoned for commercial/industrial use and would have correspondingly higher ambient sound levels than at residential locations.

8.58 In response to the second issue, based on these predicted noise levels, I am of the opinion that the noise impacts to surrounding commercial properties have been adequately considered and that no further noise mitigation or assessment is required.

8.59 In relation to the issue of inconsistencies relating to the reported number of heavy vehicle movements per day and the overall duration of works, I note that the total number of vehicle movements for this site has been updated since the Noise Report was prepared and that the numbers quoted in the AEE are correct. Based on the revised number of truck movements I predict that daytime and evening traffic noise levels from May Road and State Highway 20 will increase by no more than 1 decibel which would be of little appreciable effect in this highly trafficked commercial area.

8.60 Lastly, it is generally accepted that noise from construction projects, particularly large-scale projects such as these that take place over more than 1 year, cannot practicably be constrained within the noise limits applicable to normal activity. To do so would place overly onerous restrictions on these projects and stifle, and in some cases, prevent development. The approach taken by the Proposed Designation Conditions is that noise should be no louder than necessary and should occur within appropriate hours.

Conclusion on submissions

8.61 In the section above I have responded to the noise concerns raised by submitters. Although extensive assessment has been undertaken and a significant level of detail provided for possible mitigation measures, at this stage of the Project it is not possible to determine the specific mitigation measures that will be implemented. On completion of detailed design and the construction methodology specified, site specific mitigation requirements will be determined in consultation with relevant parties. The Proposed Designation Conditions require the development of a comprehensive CNVMP in accordance with the provisions of NZS 6803: 1999, which will include detail of intended mitigation measures for each site.

8.62 I observe that the formulation of a CNVMP, including detailed mitigation measures, following the finalisation of project detailed design, is standard practice for large infrastructure projects of this type.

8.63 I am satisfied that the concerns of submitters can be adequately addressed through the Proposed Designation Conditions.

9. RESPONSE TO COUNCIL PRE-HEARING REPORT

9.1 I have reviewed the Auckland Council Pre-hearing Report ("PHR")¹⁴ as it relates to noise and note that the PHR includes reference to PHR number 15 authored by Mr Styles.

¹⁴ Hearing report for notices of requirement under section 168 of the Resource Management Act 1991 and applications for resource consent under section 88 by Watercare Services Limited – Central Interceptor Project, Auckland (27 June 2013) ("**Pre-hearing Report**").

9.2 The PHR quotes Mr Styles' conclusion that:¹⁵

Overall, I agree with the MDA Assessments that for certain noisy activities...there will be short term adverse effects that are likely to cause a significant disturbance...such activities will not endure for the entire construction period, and will likely only be intermittently noisy for periods of a few hours up to perhaps 2 months.

9.3 The PHR concludes that:¹⁶

...the noise effects from construction activities can be appropriately managed through the implementation of site specific CNVMPs involving consultation with affected stakeholders. The operational noise effects can be addressed through compliance with the proposed noise conditions.

9.4 In summary, the PHR recommended additions and amendments to the proposed Construction Noise and Vibration Conditions at the recommendation of Mr Styles. It also recommended further evidence be given in response to submitter-specific concerns at one site. The following sections of the PHR are the most relevant with respect to noise:

- (a) Section 7.0: Submissions (pages 52-53)
- (b) Section 9.3.5: Noise Effects (pages 117-123)
- (c) Section 10.8.5: Assessment of alternative locations and layouts for the Construction Sites (pages 200-201, 204)
- (d) Section 14.1.1: Recommendations (page 247-249)
- (e) Section 14.3: Recommended Conditions (pages 256, 257, 258)
- (f) Section 15.4: Recommendation and Conditions (pages 292, 293)

9.5 In addition to the above, I refer to Mr Styles' report in relation to blasting noise criteria.

¹⁵ Pre-hearing Report at page 122.

¹⁶ Pre-hearing Report at page 129.

Project Noise Conditions

9.6 The PHR made a number of recommended amendments to both the proposed designation and resource consents conditions. I now discuss each amendment in turn (deletions in ~~strike through~~ and additions underlined).

9.7 The Council's version of proposed CNV.1¹⁷ states:

A Construction Noise and Vibration Management Plan (CNVMP) shall be prepared for ~~each site the Project or relevant Project stage,~~ either as part of the CMP, or as a standalone plan, and shall be prepared by a suitably qualified person.

9.8 Whilst I acknowledge that each construction site is inherently different and that the expected degree of noise effects is varied across all sites, there would be a considerable number of sites where similar effects would occur, which would warrant similar management and mitigation methods. I also note that it is common for large infrastructure projects to have one main CNVMP and for site specific issues to be addressed as and when required using site specific CNVMPs. I propose that this is best addressed through an amendment to CNV.4(h),¹⁸ as follows:

- (h) ~~development of alternative management strategies where full compliance with NZS6803:1999 cannot be achieved, the CNVMP shall set out the Best Practicable Option for the mitigation of the noise levels specific to each activity for each site, including physical mitigation, restrictions on hours for the noisy work, consultation and monitoring~~ set out the methodology for handling non-compliances (including drafting site specific CNVMPs) so that the Best Practicable Option is adopted;

9.9 This amendment is included in Watercare's Proposed Conditions, as attached to the evidence of Ms Petersen.

¹⁷ As well as Proposed Consent Condition 1.10.

¹⁸ As well as Proposed Consent Condition 1.10(i).

9.10 I therefore oppose the Council's proposed amendment in CNV.1, and support the version of this condition in Watercare's Proposed Conditions attached to the evidence of Ms Petersen.

9.11 The Council also proposes a new Condition, CNV.3, as follows:

Noisy construction works, (that exceed a level of L_{Aeq} 45dB at the most exposed receiver(s) are restricted to between 0730 to 1800 on weekdays, 0730 to 1500 on Saturdays with no noisy works permitted on Sundays and Public Holidays. The CNVMP shall define which activities will comply [sic] a limit of L_{Aeq} 45dB and can therefore be undertaken outside of these hours in compliance with condition CH.1[sic].

9.12 Whilst I agree with the intent of CNV.3, it proposes a reduction in working hours on Saturdays to less than those contained in the provisions of NZS 6803: 1999. As discussed in Paragraph 8.42, Saturday is now recognised by NZS 6803: 1999 as being a normal construction working day and I note that the proposed Project Noise Controls reflect this. Enabling work to occur on Saturdays in accordance with the provisions of NZS 6803: 1999 would also allow the overall duration of works, and therefore potential noise effects, to be shorter. I therefore propose that CNV.3 be redrafted as follows:

CNV.3 ~~Noisy e~~Construction works (that ~~which~~ exceed a level of 45dB L_{Aeq} at the most exposed receiver(s) are restricted to between 0730 to 1800 on weekdays, ~~0730 to 1500 on~~ and Saturdays with no noisy works permitted on Sundays and Public Holidays. The CNVMP shall define which activities will comply a limit of 45dB L_{Aeq} and can therefore be undertaken outside of these hours in compliance with condition CH.1.

9.13 As well as the amendment recommended for CNV.4(h) above, I am of the view that there should be further minor changes made to the Council's version of CNV.4¹⁹. The Council has proposed to amend CNV.4 as follows:

The CNVMP shall, as a minimum, address the following aspects with regard to construction noise:

- (a) *a description of noise sources, including machinery, equipment and construction techniques to be used;*

¹⁹

As well as Proposed Consent Condition 1.10.

- (b) *predicted construction noise levels;*
- (c) *hours of operation, including times and days when noisy construction work and blasting would occur in compliance with condition CNV.4;*
- (d) *physical noise mitigation measures, including prohibition of reverse alarms, maintenance of access roads (to ensure they are smooth), acoustic screening around the site, plant selection and maintenance procedures, and site layout;*
- (e) *construction noise criteria for any specific areas and sensitive receivers such as schools, child care centres, medical or aged care facilities;*
- (f) *the identification of activities and locations that will require the design of noise mitigation measures such as temporary barriers or enclosures and the details of such measures where the Project noise criteria are predicted to be exceeded;*
- (g) *the measures that will be undertaken by the Requiring Authority to communicate and obtain feedback from affected stakeholders on noise management measures to affected stakeholders;*
- (g) *~~development of alternative management strategies where full compliance with NZS6803:1999 cannot be achieved, the~~ CNVMP shall set out the Best Practicable Option for the mitigation of the noise levels specific to each activity for each site, including physical mitigation, restrictions on hours for the noisy work, consultation and monitoring;*
- (h) *methods for monitoring and reporting on construction noise, including additional monitoring required for activities that cannot comply with the criteria in NZS6803:1999;*
- (i) *methods for receiving and responding to complaints about construction noise; and*
- (j) *construction operator training procedures.*

9.14 I generally agree with the proposed amendments to CNV.4, subject to the minor change set out above and the following additional amendments:

- (d) *physical noise mitigation measures, including ~~prohibition~~ limiting the use of reverse alarms during night-time works, maintenance of access roads (to ensure they are smooth),*

acoustic screening around the site, plant selection and maintenance procedures, and site layout.

...

- (f) the identification of activities and locations that will require the design of noise mitigation measures ~~such as temporary barriers or enclosures and the details of such measures where the Project noise criteria are predicted to be exceeded;~~

...

9.15 The additional amendment to (d) reflects that it may be appropriate in some situations that reverse alarms be used, albeit only during the day.

9.16 The amendment to (f) reflects the fact that generally a project-wide CNVMP will not go into detail with regards to mitigation measures to address more specific issues, and these will instead be dealt with through the site specific CNVMPs where required. I have therefore proposed an amendment to (f) to delete the additional detail that I consider to be unnecessarily prescriptive in this particular context.

9.17 I agree with the remainder of the changes to CNV.4²⁰ recommended in Watercare's Proposed Conditions.

Blasting Noise Criteria

9.18 Mr Styles has suggested a new condition controlling the noise and vibration effects from blasting. He notes that:²¹

...requiring compliance with a single limit is possibly more restrictive than it might need to be, and that it is acceptable to have two air overpressure limits that apply depending on whether the receiving building is occupied...I consider that the following limits would be appropriate for the CI project:

- i) *For buildings that are not occupied for any blast, the air overpressure limit shall be L_{peak} 133dBZ;*

²⁰ As well as Proposed Consent Condition 1.10.

²¹ Jon Styles, *Central Interceptor Scheme Review of Noise & Vibration Effects* (24 June 2013) at page 5.

ii) For buildings that are occupied for any blast, and where there is less than 20 blasts to be undertaken on the site over the entire project the air overpressure limit shall be L_{peak} 128dBZ; and

iii) For buildings that are occupied for any blast, and where there is more than 20 blasts to be undertaken on the site over the entire project the air overpressure limit shall be L_{peak} 120dBZ;

9.19 I agree that a blasting limit should be included in the conditions, and that it is restrictive to require compliance with a single limit. I also consider that in situations such as these it is entirely appropriate to allow for some flexibility in the limits applied. However, my recommended approach does differ slightly from that suggested by Mr Styles. I will now explain my reasoning, and then suggest appropriate wording below.

9.20 Mr Styles' proposed criteria draws heavily upon Australian Standard AS2187.2-2006 *Explosives – Storage and Use, Part 2: Use of Explosives*.²²

9.21 The first criterion applies when all buildings are not occupied. In my view the intention of criterion (i) is to protect against architectural damage to buildings, specifically the breaking of windows. I consider a level of 133dBZ to be conservative. I note that the "dBZ" descriptor is the same as "dB (lin)". I draw attention to British Standard BS 5228-1: 2009²³ which notes

Windows are generally the weakest parts of a structure and research by the United States Bureau of Mines...has shown that a poorly mounted window that is prestressed might crack at 150 dB (lin), with most windows cracking at around 170 dB (lin), whereas structural damage would not be expected at levels below 180 dB (lin).

9.22 A limit of 133dBZ is well below the 150-170 dB (lin) levels noted in the British Standard. I consider criterion (i) would be an overly conservative limit. However, given the proximity of dwellings at sites where blasting may occur I consider it would be preferable to control air overpressure limits by reference to

²² Tables J5.4(A) and (B)

²³ BS 5228-1: 2009 Annex I Section I.3 paragraph 3 (page 151)

the human comfort criteria, instead of the architectural damage criteria. This is because the human comfort level is lower than the architectural damage criteria, and by applying this lower level all of time both humans and buildings will be protected during all blasting. Therefore, I consider that criterion (i) would not be required in this instance.

9.23 Mr Styles' criteria (ii) and (iii) apply when buildings are potentially occupied. The levels relate to human comfort and annoyance. I agree that such controls should be imposed, but I also consider that the use of a statistical approach should be adopted. I generally agree with Mr Styles' criteria (ii) and (iii), but have proposed a similar statistical approach to that adopted by Mr Millar in relation to the limits on vibration in criterion (b). The wording of criterion (b) was prepared in conjunction with Mr Millar and I am satisfied with the approach taken.

9.24 My proposed new condition CNV.5A²⁴ is as follows:

CNV.5A Blasting activities may exceed the limits of NZS 6803: 1999 Acoustics – Construction Noise subject to the following:

- (a) Where there is less than 20 blasts to be undertaken on the site over the entire project, the air overpressure limit shall be L_{peak} 128dBZ; and
- (b) Where there is more than 20 blasts to be undertaken on the site over the entire project, the air overpressure limit of L_{peak} 122dBZ shall not be exceeded more than 5% of the time, and no blast shall exceed L_{peak} 128dBZ.

9.25 A minor consequential amendment is required to CNV.2²⁵ to reflect that the limits applying to blasting will be different from those applying to the remainder of the Project works. These amendments are shown in Watercare's Proposed Conditions, attached to the evidence of Ms Petersen.

²⁴ As well as Proposed Consent Condition 1.10A.

²⁵ As well as Proposed Consent Condition 1.10.

9.26 **Operational Noise Conditions**

9.27 I have also proposed several very small changes to proposed Designation Condition ON.1 in the Pre-hearing Report as follows. The first clarifies where the noise is to be measured, and the amendment in the table is simply to delete redundant text:

The noise arising from any operational activities undertaken on the designated land, shall not exceed the following noise limits when measured within ~~at~~ the boundary of any site zoned as follows:

Residential		
Day	Time	Noise Limit*
Any day	0700-2200 hours	50 dB LAeq
Any day	2200-0700 hours	40 dB LAeq 75 dB LAmax
Business		
Day	Time	Noise Limit
Any day	At all times	60 dB LAeq

Mount Albert War Memorial Reserve - Car Park Site

9.28 The PHR noted that 22 submissions were received in relation to Plan Modification 357 ("PM 357") (the alternative Car Park Site at the Mount Albert War Memorial Reserve). Twenty submissions conditionally supported the Car Park site based on a lessening of the severity of construction effects on residents; two submitters (including CORT) opposed it on the grounds that construction effects would be greater.

9.29 The PHR recommended to the Requiring Authority, subject to it supplying adequate responses on issues raised in the body of the report, that the Notice of Requirement as it relates to the Mount Albert War Memorial Reserve site be *withdrawn* and that the Notice of Requirement for the Car Park site be *confirmed*. The PHR noted the following:²⁶

²⁶

Pre-hearing Report at page 255.

It is considered, on balance, that the construction effects from PM 357 site within the lower car park can be more readily avoided, remedied or mitigated.

9.30 In response to the submitters in opposition to PM 357, I note that Watercare has revised the layout for the Car Park site and shifted the control chamber and associated construction works further from the boundary with 9 Wairere Avenue.²⁷ I also note that Watercare now proposes to include a noise barrier along the construction access road.²⁸

9.31 I consider the measures proposed by Watercare constitute the adoption of the BPO in this instance in regard to the mitigation of adverse effects. I consider an acceptable outcome can be achieved through the CNVMP and therefore conclude that no further condition amendments or mitigation measures are necessary in relation to the Car Park site.

10. CONCLUSIONS

10.1 I conclude that the noise generated by construction activity can, in the main, comply with the Project Noise Controls. Where non-compliance is predicted, practicable mitigation and management measurements would be implemented through the CNVMP including consultation with affected parties to achieve acceptable outcomes. I consider that where the BPO is adopted, in conjunction with community consultation and feedback via the CNVMP, this would result in the construction noise effects being controlled to acceptable levels.

10.2 I support the adoption of Watercare's Proposed Conditions relating to construction and operation noise, including the use of a Construction Noise and Vibration Management Plan.

Mathew John Cottle

12 July 2013

²⁷ Refer AEE-MAIN-2.1A Issue D and AEE-MAIN-2.2A Issue E at pages 49 and 50 of the Hearing Drawing Set.

²⁸ Refer AEE-MAIN-2.2 Issue C and AEE-MAIN-2.2A Issue E at pages 39 and 50 of the Hearing Drawing Set.