

Technical Report 10

AECOM – Construction Noise Assessment

Wellington Airport Runway Extension

Assessment of Construction Noise Effects

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Client: Wellington International Airport Limited

Co No.: 396240

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26-Apr-2016

Job No.: 42199020

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Quality Information

Document	Wellington Airport Runway Extension
Ref	42199020
Date	26-Apr-2016
Prepared by	Darran Humpheson
Reviewed by	Michael Smith

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Abbreviations

Abbreviation	Description
AGL	Aeronautical Ground Lighting
APU	Auxiliary Power Unit
AS	Australian Standard
CRTN	Calculation of Road Traffic Noise
CNVMP	Construction Noise and Vibration Management Plan
CTMP	Construction Traffic Management Plan
CuM	Cubic metre
dB	Decibel - A measurement of sound level which has its frequency characteristics modified by a filter (usually A-weighted) so as to more closely approximate the frequency bias of the human ear.
GWRC	Greater Wellington Regional Council
L_{Aeq}	The A-weighted time averaged sound level over the measurement period t.
L_{Amax}	The maximum A-weighted sound level of a noise event or measurement period.
L_{Amin}	The minimum A-weighted sound level of a noise event or measurement period.
L_{A10}	The sound level which is equalled or exceeded for 10% of the measurement period.
L_{A90}	The sound level which is equalled or exceeded for 90% of the measurement period. Often referred to as the background sound level.
NZS	New Zealand Standards
OLS	Obstacle Limitation Surface
RESA	Runway End Safety Area
RMA	Resource Management Act 1991
TORA	Take Off Runway Available
WHO	World Health Organisation
WIAL	Wellington International Airport Limited

Executive Summary

The proposed southerly runway extension to Wellington Airport would involve reclaiming land from Lyall Bay and constructing a paved runway extension, taxiway and associated infrastructure. It is estimated that delivery of the new extended runway could take approximately 36-48 months and during this time, different land and water based techniques would be used to construct the extension.

An indicative worst case construction methodology has been developed, which assumes that 100% of the fill material for the reclamation will be land-based rather than using maritime options and that the construction period would be approximately 48 months. Transportation on public roads of fill material will occur Monday to Friday and large quarry truck and trailer units will be used. During the first year of construction up to 110 trucks per day are anticipated, increasing to 200 trucks per day during the bulk fill and surcharge phases. As the programme continues the number of movements is expected to reduce to 75 trucks per day.

Following the public consultation process, separate daytime and night time haulage routes have been established via different routes. The daytime route has the ability to accommodate up to 30 trucks per hour between the hours of 0930h and 1430h, resulting in a maximum of 150 trucks per day. The night time route is noise constrained and the assessment has concluded that a maximum of 160 trucks would be allowable on a staggered basis between 2200h and 0600h.

Operational restrictions at the airport place limitations on where and when certain construction works would occur. These restrictions apply to construction plant that may pose a flight safety risk within the reclamation area during the construction of the rock dyke, placement of the accropodes, any stone column installation within the northern portions of the reclamation fill and ground improvements within the reclamation fill. For these work elements, construction during the scheduled aircraft night time curfew period (0000h to 0600h) would be necessary. During this period, ambient noise levels from the airport and other sources of noise will be at their lowest and any night time works have the potential to increase the likelihood of disturbance to nearby residents.

As is normal for projects that are at the preliminary design stage, a contractor has not yet been appointed and specific construction plant and methodologies cannot yet be fully determined. Therefore, the construction noise assessment has considered indicative construction activities to make a broad assessment of noise and vibration levels and to determine the extent of likely effects and whether those effects can be appropriately managed.

Once the plant and methodologies are confirmed by the contractor, a project specific Construction Noise and Vibration Management Plan (**CNVMP**) (and relevant CNVMP schedules) will be finalised and will detail specific mitigation and management measures that will be adopted. The principle contractor will be required to prepare and operate under the CNVMP, which will include predictions of construction noise and identifying necessary mitigation measures. Wellington International Airport Limited (**WIAL**) will form a Construction Liaison Group to discuss environmental issues raised by the construction process.

Where practicable adverse construction noise effects will be mitigated by management and onsite measures to an acceptable level. Where adverse impacts are predicted offsite, WIAL will also consider a range of specific mitigation options for the most affected dwellings.

1.0 Introduction

- 1 Wellington Airport currently operates on a single 1,945 m long runway (Take Off Runway Available - TORA) with 90 m Runway End Safety Area (RESA) at each runway end. Wellington International Airport Limited (WIAL) proposes to extend the southerly runway into Lyall Bay to deliver a minimum TORA of 2,300 m, i.e. an approximate 355 m runway extension to runway 34 (runway direction 16 would remain unchanged). The extension would allow Wellington Airport to accommodate most Code E aircraft types with sufficient load capacity to and from east Asian and western North American destinations.
- 2 The runway extension project would involve reclaiming land from the sea and constructing a paved runway extension, taxiway and associated infrastructure. **Figure 1** shows the extent of the proposed works.
- 3 It is estimated that delivery of the new extended runway could take approximately 36-48 months, depending upon a number of factors as discussed later in this report. During this time, different land and water based techniques would be used to construct the extension. Certain construction activities during airport operating hours are constrained as they could pose a flight safety risk. Because of these operational restrictions, a portion of runway extension construction work would occur at night when scheduled domestic aircraft movements are restricted between 0000h to 0600h and between 0100h to 0600h for international aircraft arrivals, subject to the usual allowances for delayed flights or exemptions for emergencies. During this period, ambient noise levels from the airport and other sources of noise will be at their lowest and any night time works have the potential to increase the likelihood of disturbance to nearby residents.
- 4 This report has been prepared to consider potential construction noise and vibration effects associated with the southerly runway extension on existing noise sensitive receptors within the vicinity and the proposed construction vehicle haulage routes. The report also identifies a range of mitigation measures to manage construction noise, including a commitment to undertake noise monitoring during the construction period. These mitigation measures are detailed within the draft Construction Noise and Vibration Management Plan (CNVMP).
- 5 An aircraft noise report which considers noise once the new runway is operational has been prepared by Marshall Day Acoustics.
- 6 This construction noise report is structured as follows:
 - Section 2 provides an overview of the project.
 - Section 3 reviews the construction noise framework.
 - Section 4 reviews the existing environment and baseline noise levels.
 - Section 5 details the assessment process.
 - Section 6 provides an assessment of environmental effects.
 - Section 7 describes the mitigation that will be adopted, including a draft CNVMP.
 - Section 8 provides conclusions and recommendations.

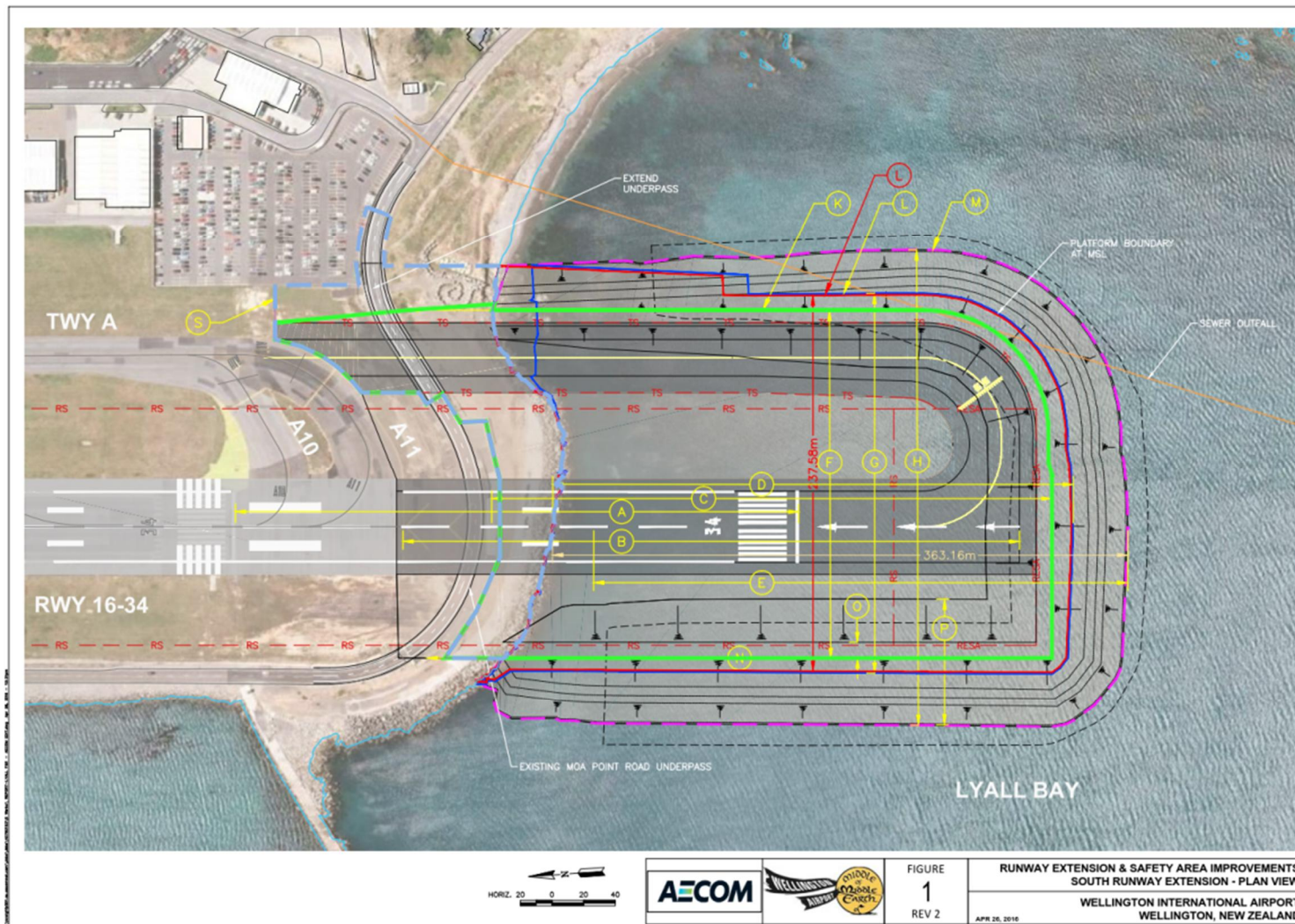


Figure 1 Extent of the proposed runway extension

2.0 Project description

2.1 Overview

- 7 WIAL is proposing to build a runway extension at Wellington Airport to achieve a minimum TORA of 2,300 m by land reclamation within Lyall Bay.
- 8 The extended runway would include a new taxiway extension and additional infrastructure such as a 90 m RESA, aeronautical ground lighting (**AGL**), new runway signage, relocated navigation aids and underground utilities. The existing Moa Point Road tunnel under runway 34 at the south end would require modification to account for the taxiway extension. The geometry of the runway/taxiway has been designed to accommodate Code E aircraft (e.g. 777-300ER and A330) and the occasional larger aircraft. The design includes a new temporary taxiway connector. This feature has been included to facilitate airfield operations during construction periods when the runway may need to be temporarily shortened to facilitate construction activities.
- 9 Based upon the engineering design and above constraints, an indicative worst case construction methodology has been developed, which assumes that 100% of the fill material for the reclamation will be land-based delivered by quarry truck and trailer units. This programme assumes a 48 month construction period due to constraints on the number of trucks that can be accommodated at any one time on the construction site. If a combination of land-based fill and dredged sediments are used then the programme may be reduced to 36 months (or less). The general staging of the project and likely duration of each stage is expected to be as follows (noting that the actual staging of the works will be determined by the successful contractor and that there is likely to be concurrent working):
- Stage 0 – 2 months: Establishment of site compound.
 - Stage A – 14 months: Installation of stone columns beneath the rock dyke, if required. Commence installation of stone columns from the start of the eastern/western seawalls (existing land) and 1/3 along the seawall working outwards into deeper water. Occasionally, there may be periods of time when night work for the installation of stone columns under the western and eastern dykes is required to keep the project to programme.
 - Stage B – 14 months: Once stone columns are sufficiently advanced, commence installation of stone blanket over stone columns and adjacent filter layer on seabed and secondary armour layer over seabed filter layer. Trim all rock to final profile.
 - Stage C – 14 months: Once stone blanket, seabed filter layer, and secondary armour over seabed filter are sufficiently advanced, commence installation of core rock to the rock dyke. Remove existing Akmon armour units in the immediate vicinity where land-based operations have commenced.
 - Stage D – 14 months: Progressively place filter layer to outside of core batter, and trim to profile. Trim top of core material to obtain filter profile to complete placement of filter material.
 - Stage E – 15 months: Once the core section and filter layer are sufficiently advanced, place primary armour to toe; secondary armour over batter filter layer; followed by outer primary armour to batter. Progressively recover existing Akmon armour units to place on outside of new eastern rock dyke.
 - Stage F – 13 months: Complete core and filter to top surface, and then place secondary armour and primary armour top (horizontal) layers. Leave out accropodes immediately adjacent to precast concrete wall location.
 - Stage G – 1 month: Fabricate geotextile into large panels and roll onto mandrel. Fix geotextile to top of rock dyke and roll down the batter.
 - Stage H – 5 months: Construction reclamation using locally dredged material and marine-based equipment. Alternatively, up to 18 months using land-based (and possibly marine based) equipment and land-based fill material: For the marine-based method, establish pumping connections and locations for off-load of the dredged material from marine-based equipment, as well as flow discharge points from reclamation. Commence reclamation from end of existing runway working outwards toward the southern rock dyke,

relocating flow discharge points as needed. Once entire reclamation is filled, place final dredged layer to finished surface level. For the land-based method place fill across the east-west width of the reclamation and progress in a southerly direction, starting at the southern end of the existing land.

- Stage I – 3 months: Once reclamation is complete, place precast concrete wave wall units (approximately 3 m long precast units at approximately 30 tonnes each) using crawler crane. Place final accropodes in position adjacent to the precast structure. Place precast drain and graded gravel surface to top surface of precast units.
- Stage J – 1 month for wick drains, 10 months for surcharge including 8 months for consolidation: Commence installation of wick drains to reclamation. Once 50 percent of an area is completed, commence construction of surcharge if required. Alternatively, perform ground improvement (such as vibrocompaction) of reclamation fill materials.
- Stage K - 10 months: Remove surcharge if required. Construct airfield drainage, pavements, and install navigation lighting, etc. Construct amenity improvements to Moa Point Road and Moa Point Beach.

10 There are four main (inter-related) constraints associated with this project:

- Building a runway extension at an operating airport which is located in a fairly densely developed urban/suburban environment.
- The weather and sea conditions in Lyall Bay.
- The logistics associated with moving and placing a large quantity of bulk material by land-based transport.
- The use of specialist plant to facilitate the reclamation works.

11 The Airport's Obstacle Limitation Surface (**OLS**) is one of the most significant constraints for the project and is necessary to enable aircraft to maintain a satisfactory level of safety while manoeuvring at low altitude in the vicinity of the runway. The OLS defines the surfaces in the airspace above and adjacent to the airport. These surfaces should be free of obstacles and are subject to controls such as the establishment of zones, where the erection of buildings, masts, and so on, that may penetrate the OLS are prohibited. These restrictions also apply to temporary structures such as construction works, e.g. use of cranes, towers etc.

12 At the reclamation site, the OLS constrains the construction of the rock dyke and runway to specific plant and equipment. This plant and equipment would be required to fit under the OLS for the construction of the southern dyke. However, it is likely that equipment would penetrate the OLS for select elements of the work, such as some of the construction of the western and eastern dykes, placement of the Akmons/accropodes, any stone column installation within the northern portions of the reclamation fill and ground improvements within the reclamation fill. For these work elements, construction during the scheduled aircraft night time curfew period would be necessary. During the curfew period a wedge shaped portion of the reclamation fill will most likely have to be constructed using approximately 230,000 CuM of fill based on a 6 m working headroom and 160,000 CuM based on a 4 m working headroom.

13 The weather and sea conditions in Lyall Bay is likely to be a significant constraint and hence necessitate a greater reliance on land based techniques. As the assessment considers a worst case of 100% of the fill material being imported by land-based means, then the assessment addresses this particular constraint.

14 The remaining two constraints are dealt with in the following section.

2.2 Transportation of materials

15 There could be in the order of 1.5 M CuM of fill and other material requiring transport to the site. These materials would be conveyed to the construction site via a to-be-determined combination of land based and water based transport. As already noted this assessment assumes a total reliance on land based transportation of fill materials.

- 16 The assessment assumes that the majority of suitable material will be sourced from Wellington quarries (Kiwi Point Quarry and Horokiwi Quarry) and a number of routes and logistic options have been considered. The preferred option is to use a combination of separate day and night time haulage routes, with corresponding different numbers of traffic movements. The day time route being necessary to minimise traffic impacts on the surrounding road network, whereas the night time route has been planned to minimise noise disturbance. Both routes use a common route from the quarries through the city centre before continuing along SH1 towards the airport as shown in **Figure 2**.
- 17 The daytime route (**Figure 3**) has been designed to work within the existing traffic conditions at existing intersections along the route and includes a separate inbound and outbound route. The inbound route leaves Cobham Drive (SH1) and Calabar Road before entering the airport precinct along Stewart Duff Drive before entering the construction site. The outbound route leaves the work site along Moa Point Road before continuing along Lyall Parade, before turning on Onepu Road and Evans Bay Road before re-joining SH1. This daytime route has the ability to accommodate up to 30 trucks per hour between the hours of 0930h and 1430h, resulting in a maximum of 150 trucks per day. Further details can be found in the Transport Assessment which has been produced by the Traffic Design Group (TDG).
- 18 The night time route (**Figure 4**) uses the same haul route from Cobham Drive (SH1) before entering the airport precinct via Calabar Road, i.e. an identical route to the daytime inbound route. As detailed later in Section 6.2.3, night time movements are noise constrained and the assessment has concluded that a maximum of 160 trucks would be acceptable on a staggered basis between 2200h and 0600h.
- 19 TDG's Transport Assessment has estimated the required number of trucks per day based upon the volumes of material and the phases of the construction programme. During the first year of construction up to 110 trucks per day are anticipated. During the bulk fill and surcharge phases of the project there could be up to 200 trucks per day. As the programme continues, the number of movements is expected to reduce to 75 trucks per day. As will be shown later in this chapter, the combined peak number of trucks which can be accommodated on the daytime and night time haul routes within acceptable traffic and noise limits is 310 trucks per day. This exceeds the estimated maximum of 200 estimated trucks per day and enables a degree of flexibility in scheduling truck movements throughout the entire 24 hour period.
- 20 Transportation of construction materials on public roads will occur Monday to Friday and large quarry truck and trailer units will be used. Once off the state highway and within residential areas, but not Calabar Road (as it is a free flowing road), the trucks will travel at a speed of 30 km/h, which will help to minimise any acceleration and deceleration which have the potential to increase road-traffic noise levels. Furthermore, the road surfaces of the access routes will be appropriately maintained to ensure that rattle and bang noise from empty trucks and trailers is minimised as far as practicable.
- 21 There may be occasions when abnormal vehicle movements are likely, for example delivery of large construction plant. In these situations the main airport access route would be used, i.e. loads would travel through a restricted access gate, across the front of the main terminal building to the work area on the eastern side of the main runway. The noise associated with abnormal loads has been scoped out of this assessment as they would be infrequent, slow moving and will occur outside of peak traffic periods which could indirectly lead to increased congestion and hence noise.
- 22 Transportation of materials via water based means is likely to include a fleet of bottom dump barges which will import reclamation fill from either a port / wharf, 'borrow pit' or via dredging and then transferred to the construction site or to a temporary staging pontoon/berth. The barges are anticipated to operate on a revolving basis until such time that they can no longer float over the rock dyke.

- 23 As is the case with most construction projects, a contractor has yet to be appointed and therefore the exact means of importing material (by road / water) has not yet been determined. For the purposes of this assessment it has been assumed that there will be separate day time and night time vehicle routes for importation of land-based fill and an estimated six barge trips per day (i.e. 12 two-way movements). The assessment has assumed that these barges would support the installation of any stone columns and not dredged fill as the assessment assumes that 100% of materials will be imported by road. There would also be additional boat movements from support vessels, which are estimated to be four movements in any one day.

2.3 Construction Plant

- 24 As a contractor has not yet been appointed, the exact plant to be used is unknown. Based on similar projects involving reclamation, a variety of onshore and marine-based plant are likely to be used. The weather and sea conditions within Lyall Bay are constraints and will influence the construction programme and use of marine-based plant. The proposed construction programme has taken into account likely delays due to weather and is based on a worst case construction period of 48 months assuming 100% of fill material is imported using land based techniques.
- 25 **Appendix A** provides details of the land and marine-based plant that is likely to be used including the sound level of the plant expressed as a sound pressure level at a specified distance. The presented data is likely to be a reasonable estimate of the source sound level data of the various items and will enable the likely significant effects of the proposed construction activities to be assessed.
- 26 Typical marine-based plant will include (but not limited to) floating crane barges, deck barges, hopper barges, dredge plant (various), anchor barges and support vessels such as tugs and tender vessels. It has been assumed that the reclamation site will include piling activities (stone columns). It has also been assumed that to facilitate construction during less than ideal (i.e. not calm) weather conditions, when demobilisation from the work area by construction vessels would result in significant lost time, temporary moorings will be provided and these will be piled. A number of options are available, which could include use of 900 mm diameter steel piles for fixed piers and possibly the installation of a wave barrier made from approximately 124 driven steel piles.
- 27 Typical land-based plant will include (but is not limited to) tipper trucks and trailers, long arm excavators, stone column rigs, bulldozers, loaders, forklifts, crawler cranes, dump trucks and paving plant. Vibration compaction plant is likely to be used for ground improvements within the reclamation site. It is likely that the equipment used for this work will sit under the OLS, but penetrations into the OLS will be considered. In some cases it may be required to undertake these works during the night-time period.
- 28 Operating times of the marine-based plant will vary according to the works being done and the weather and sea state conditions. It has been estimated that the marine-based plant will be operating for approximately 50% of the construction period. For example, during installation of any stone columns required, the plant is likely to only be inserting the stone columns for half the period because of setting up time, etc. These estimations exclude the time the barge or operating platform is on site when no significant noise would be generated.
- 29 Land-based plant is likely to operate for a longer period due to fewer constraints compared to the marine-based activities. A likely worst case estimate is around 75% for land based plant.

- 30 It has been assumed that based upon the volume of fill ($160,000 \text{ CuM}^1$ and $230,000 \text{ CuM}^2$) which is expected to occur during the night time period of 0100h to 0600h (due to OLS restrictions), night-time operations could account for up to 20% of the total bulk fill works.

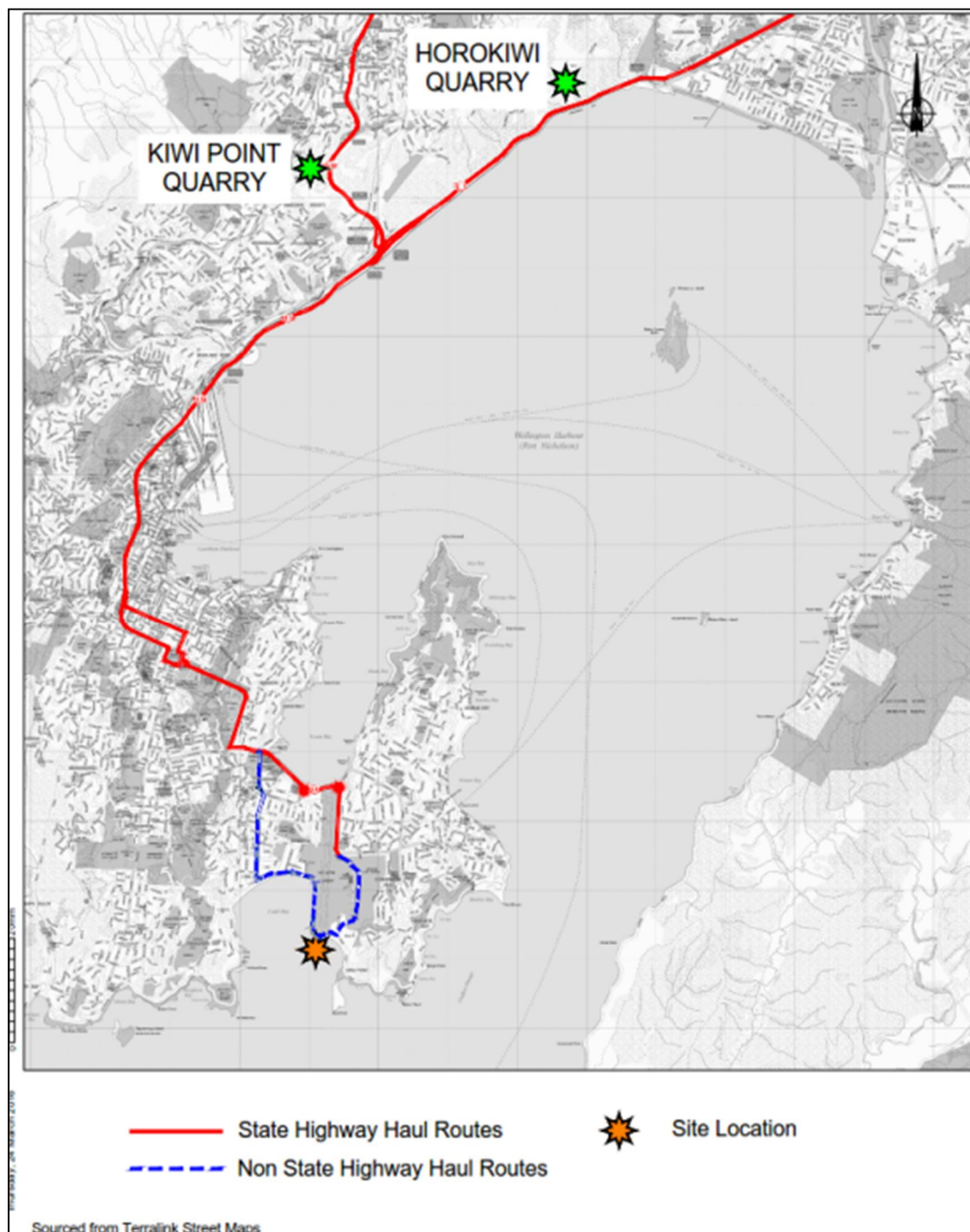


Figure 2 Route from the proposed quarry locations to the airport

¹ Based on a 4 m working headroom between any plant and the OLS

² Based on a 6 m working headroom between any plant and the OLS

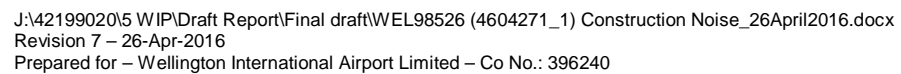


Figure 4 Night time haulage route



3.0 Relevant Statutory Documents, Regulations and Standards

31 The following documents assist in establishing the assessment required with regard to construction noise:

- The Resource Management Act 1991
- The Greater Wellington Regional Council (**GWRC**) Regional Coastal Plan
- GWRC Proposed Natural Resources Plan for the Wellington Region
- Wellington City Council District Plan
- NZS 6801:2008 – Acoustics – Measurement of environmental noise
- NZS 6802:2008 – Acoustics – Environmental noise
- NZS 6803:1999 – Acoustics – Construction noise
- AS NZ 2107:2000 – Acoustics – Recommended design sound level and reverberation times for building interiors

3.1 RMA – general

- 32 There is a general duty contained in Section 16 of the RMA which states that: *‘Every occupier of land (including any premises in any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level.’*
- 33 WIAL is committed to minimising, as far as practicable, its environmental impact associated with the runway extension project, including disturbance due to construction activities. Further information on the measures that WIAL will impose to manage construction noise is provided within Section 7.0 of this report.

3.2 New Zealand Standards

- 34 New Zealand Standard NZS 6802:2008 sets out a procedure for the assessment of environmental noise for compliance with noise limits and provides guidance for the setting of noise limits for consent conditions, rules or national environmental standards. New Zealand Standard NZS 6803:1999 “Acoustics – Construction Noise” provides the accepted construction management framework. The Standard also provides recommended noise limits for construction activities and further information is provided in the relevant section below.
- 35 The Foreword of NZS 6803 notes that *‘the generally acceptable level of intrusive noise in the community is assessed under the provisions of NZS 6802:1999 [current version 2008]. However, construction noise is outside the scope of NZS 6802:1999 because it usually cannot be kept within the specified limits. 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.’*
- 36 The Foreword goes on to state that *‘this Standard should be used in conjunction with NZS 6801:1999 [current version 2008], which contains detailed requirements for the measurement of environmental sound. The standard is intended for the guidance of those involved in managing noise in the construction industry and the local authorities with responsibility for control of noise within their districts and regions under the Resource Management Act 1991’.*

3.3 GWRC Regional Coastal Plan (Operative and Proposed)

- 37 The GWRC Regional Coastal Plan became operative on 19 June 2000 and applies to the coastal marine area of the Wellington region, which includes most of the runway extension construction area. The Regional Coastal Plan identifies issues to be addressed so that the coastal marine area can be sustainably managed. Section 14.1 of the Plan covers general standards, including noise. Section 14.1.3 applies to noise from activities outside the commercial port, i.e. of relevance to the runway extension project, and states:

The following noise standards shall apply to activities permitted or controlled by a rule in this Plan, which are located within the coastal marine area and specifically reference this section within the rule (excluding noise generated within the Commercial Port Area):

(1) the activity will not cause excessive noise (defined in section 326 of the Act) outside the coastal marine area;

(2) between the hours of 7.00 am and 11.00 pm, the noise level (L10) measured at any point on the nearest Residential Area boundary shall not exceed 55dB(A);

(3) between the hours of 11.00 pm and 7.00 am, the noise level (L10) measured at any point on the nearest Residential Area boundary shall not exceed 45dB(A);

(4) single events of noise shall not exceed an Lmax sound level of 75dB(A);

(5) noise shall be measured in accordance with NZS 6802:1999. Levels shall be assessed in accordance with NZS 6802:1999. Any construction activities will meet standards specified in Table 1 of NZS 6803P:1984. Helicopter landing areas shall meet the standards specified for residential areas in Table 1 of NZS 6807:1994;

(6) conditions (1) to (4) shall not apply to the following:

(a) noise generated by navigational aids, safety signals, warning devices, or emergency pressure relief valves;

(b) noise generated by emergency work arising from the need to protect life or limb or prevent loss or serious damage to property or minimise or prevent environmental damage;

- 38 It is noted that the Plan references NZS 6803P which was updated in 1999 to become a full standard, NZS 6803:1999. There are no fundamental differences between the two versions³, and although the version cited in the Coastal Plan is applicable, the current 1999 version has been used here as representing good practice.
- 39 GWRC is currently reviewing the operative plan and the proposed Natural Resources Plan has been developed. The proposed plan's Coastal Management General Condition 5.7.2 (p), includes relevant noise standards which would apply to most of the runway extension construction area. The requirements are consistent with the operative plan's Section 14.1.3, as discussed above, but have been updated to reflect current guidance:
- (i) the activity shall not cause excessive noise (defined in section 326 of the Resource Management Act 1991) outside the coastal marine area, and
- (ii) between the hours of 7.00am and 11.00pm, the noise level (Leq) measured at any point on the nearest Residential Area boundary shall not exceed 55dB(A), and
- (iii) between the hours of 11.00pm and 7.00am, the noise level (Leq) measured at any point on the nearest Residential Area boundary shall not exceed 45dB(A), and
- (iv) single events of noise shall not exceed an Lmax sound level of 75dB(A), and
- (v) noise shall be measured and assessed in accordance with NZS 6802:2008 Acoustics – Environmental Noise, and

³ NZS 6803P requires an assessment using L_{A10} , whereas the current version uses L_{Aeq} . For construction noise the two indices are near identical. The relevant decibel values and time periods are the same, although the NZS 6803P does not have any limit for night time activities and instead states that 'no noisy construction work can take place'. No noisy operations would generally mean that with windows open, the construction noise level should be no greater than 45 dB in order to achieve an internal level of 30dB, ie to minimise any adverse effects on sleep. Hence an identical level to that stated in the NZS 6803:1999.

(vi) any construction activities shall meet standards specified in Table 1 of NZS 6803:1999 Acoustics – Construction Noise

- 40 Policy P150: (Noise and lighting) of the Proposed Natural Resources Plan states that:

“Noise in the coastal marine area shall be managed by applying the general conditions as set out in section 5.7.2 of the Plan or by adopting the best practicable option to ensure that the emission of noise does not exceed a reasonable level...”

- 41 Policy P151(Underwater noise) of the Proposed Natural Resources Plan states that:

“Use and development in the coastal marine area shall be managed to minimise the adverse effects of underwater noise on the health and well-being of marine fauna and the health and amenity values of users of the coastal marine area.”

3.4 Wellington City Council District Plan

- 42 The District Plan includes a set of objectives and rules which apply within the Airport and Golf Course Recreation Precinct (5 October 2015) to land based activities. In this area the relevant rules relating to noise (11.1.1.1.8) state that:

“Noise emission levels, from any activity within the Airport area, other than aircraft operations, engine testing and the operation of APUs (as provided for in rule 11.1.1.1.9) when measured at any residential site shall not exceed the following limits:

Monday to Saturday 7am to 10pm 55 dB L_{Aeq} (15 min)

At all other times 45 dB L_{Aeq} (15 min)

All days 10pm to 7am 75 dB L_{AFmax}”

- 43 Appendix 1 to the Precinct Rules states that:

“Activities must comply with the following noise limits.

Residential (Outer)

Noise emission levels when measured on any residential site in the Outer Residential Area must not exceed:

Monday to Saturday 7am to 7pm 50 dB L_{Aeq} (15 min)

Monday to Saturday 7pm to 10pm 45 dB L_{Aeq} (15 min)

At all other times 40 dB L_{Aeq} (15 min)

All days 10pm to 7am 65 dB L_{AFmax}

Where it is impractical to measure outside a dwelling, then measurements shall be made inside (with windows closed). Where indoor measurements are made the noise limits stated above shall be reduced by 15dB.”

- 44 These rules are not intended to address construction noise and the District Plan makes reference elsewhere to noise from construction, maintenance and demolition activities associated with designations, including the airport. It simply states that these works shall be measured and assessed using the recommendations of NZS 6803P:1984 ‘The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work’.
- 45 Vehicle noise is not controlled by the District Plan’s noise standards. However it is useful for projects that intend to intensify traffic and hence road noise to have due consideration of any residential noise standards when determining whether the effects of the proposals are acceptable. The operative WCC plan noise rule 5.6.1.1 requires noise levels occurring within a residential area to achieve certain noise standards. These standards vary

depending upon whether the receiving area is within the inner residential and medium density residential areas or the outer residential area. At night, between 2200h and 0700h, the same standards apply across the city, ie 40 dB $L_{Aeq}(15\text{ min})$ and 70 dB L_{AFmax} regardless of the day of the week.

3.5 NZS 6803:1999

- 46 NZS 6803:1999 includes a table of recommended noise limits, which depend on the time of day and the duration of construction noise. **Table 1** provides the relevant NZS 6803 noise limits for projects longer than 20 weeks. The Standard does not provide any guidance on projects which may involve construction activity significantly longer than 20 weeks, i.e. over 48 months as would be the worst case for this project.
- 47 In most cases, construction noise limits are less strict than the respective operational noise limits under the District Plan for activities (Wellington City Council's being no exception), on the basis that the effects of construction activities are of limited duration. The Standard advises that consents may be required whenever noise from construction activities exceeds the guideline noise limits which are applicable to the construction project.

Table 1 Guideline construction noise limits from NZS 6803

Receptor	Time of week	Time period	Construction limit at any one location / dB	
			$L_{Aeq}(15\text{ min})$	L_{AFmax}
Residential	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
	Sundays and public holidays	0630-0730	45	75
		0730-1800	55	85
		1800-2000	45	75
		2000-0630	45	75
Industrial and commercial	All days	0730-1800	70	-
		1800-0730	75	-

- 48 Relatively high background sound levels from sources other than construction work can mean that construction limits based upon a background plus X dB approach may be more appropriate. Therefore, it is important to quantify the existing noise environment when formulating consent conditions for construction noise emissions from the runway extension activities.

3.5.1 Management framework

- 49 In addition to the recommended noise limits, NZS 6803 provides a framework for managing construction noise. Section 8 of the Standard sets out a range on noise management measures:

- Noise management planning – via good project management to minimise noise problems arising.
- Noise reduction at source – including choice of machinery, noise enclosures and screens.
- Community relations – consultation and co-operation between the contractor and neighbours.
- Site factors – such as the existing noise environment, distance between the activity and neighbours, sensitivity of the neighbours (residential / commercial), and duration and hours of working, etc.

3.5.2 Road traffic noise – general guidance

- 50 NZS 6802:2008 provides guidance on night time noise limits between the hours of 2200h to 0700h and recommends that when measured at any point within a residential site, 45 dB $L_{Aeq(15\text{ min})}$ should be the target. The NZS 6802 target level is based on the existing guidelines issued by the World Health Organisation (**WHO**) and assume normal diurnal fluctuations in external noise, i.e. night time being quieter than the day time.
- 51 The WHO recommends that the target level of 45 dB applies to the whole⁴ of the night time period, which is often between 8 and 10 hours in duration. However, in cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, the WHO recommends that a shorter averaging period, e.g. 1 hour, may be used.⁵
- 52 NZS 6802 requires that in addition to a L_{Aeq} rating limit for night time noise, a maximum noise limit (L_{AFmax}) should also be applied to protect the majority of people from sleep disturbance and from being woken during the night. According to the WHO guidelines, for a reasonable standard in noise sensitive rooms at night (e.g. bedrooms) individual noise events should not normally exceed 45 dB L_{AFmax} more than 10 times a night. For this project, the number of potential noisy construction traffic events during the busiest construction period is substantially greater than 10 events per night. As there is no current guidance other than that issued by the WHO which quantifies the frequency of events versus the overall magnitude of the events, the normal approach is to also consider the effects in relation to the existing noise environment, i.e. whether the introduction of a new noise source or an intensification of an existing source is likely to result in a perceptible change⁶ in the existing noise environment. In these situations it is common practice to use a threshold of 3 dB as the point at which a significant effect occurs.,
- 53 Having considered the available guidance and in the context of this project, the following noise thresholds have been adopted for the construction vehicle assessment.
- 45 dB $L_{Aeq(1hr)}$ based on WHO guidance to protect against sleep disturbance effects;
 - WCC's 70 dB L_{AFmax} external noise level for single events; and
 - noise change threshold based upon the concept of 3 dB being the onset of a perceptible change.
- 54 These thresholds apply at the residential façade. Only residential dwellings have been considered in this assessment on the basis that it is these activities which would be most affected by haulage activity.

⁴ 45 dB being the average of the entire night time period.

⁵ Since the project uses hourly traffic flow data, an hourly L_{Aeq} assessment period is considered appropriate.

⁶ NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads uses a 3 dB change as the basis of whether mitigation is warranted and whether an increase or decrease in noise is considered significant. Generally speaking a 3 dB change in a noise level is considered just perceptible.

4.0 Existing environment

4.1 Current situation

- 55 The Airport operates on a single runway with two directions; runways 16 and 34. Runway 34 threshold lies to the south of the airport at Lyall Bay. The main airport site is to the east of the runway and additional facilities are on the western side of the runway. There are no dwellings beneath the extended runway centre line due to the presence of Evans Bay to the north and Lyall Bay to the south. Residential areas are sited off the runway centre line and are shown in **Figure 5** along with the residential receptor locations where existing noise levels were measured.

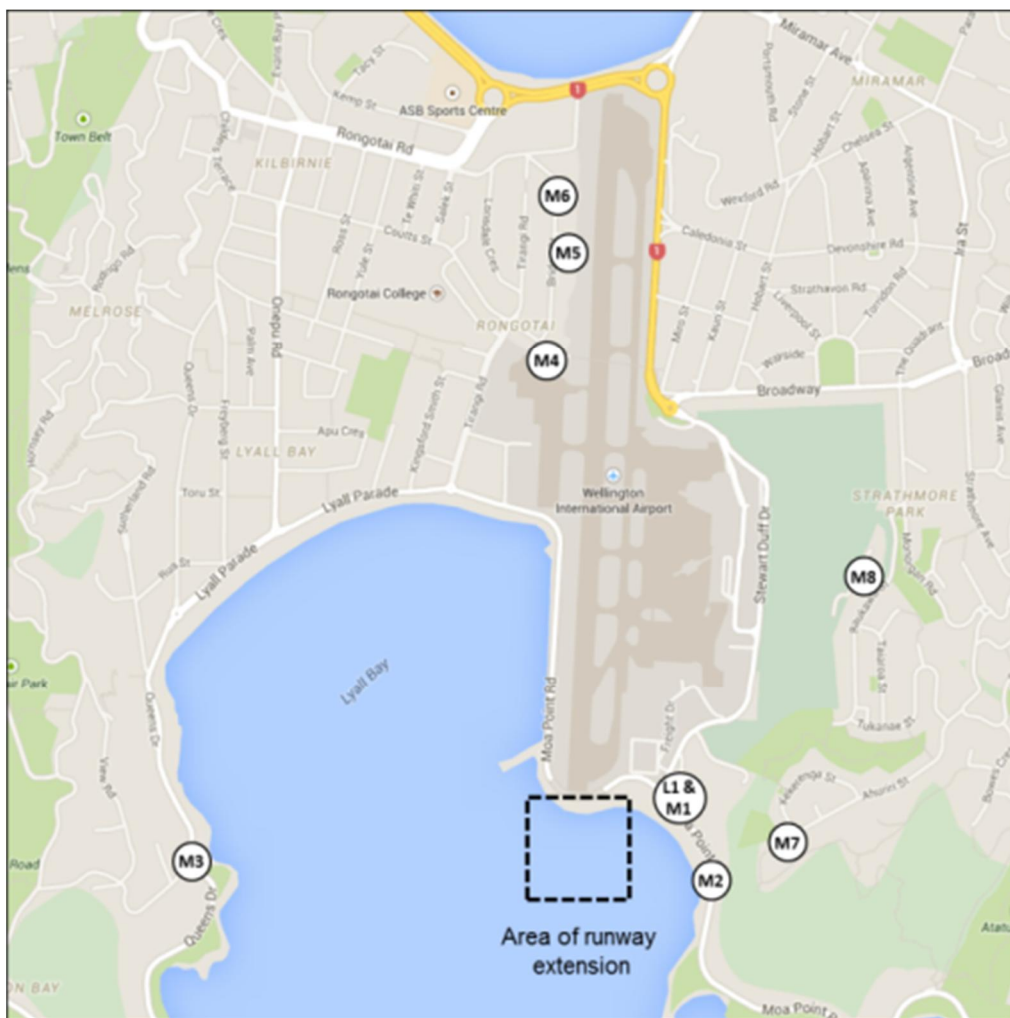


Figure 5 Site location plan with measured receivers shown (based map courtesy of Goggle maps)

- L1 36a Moa Point Road
- M1 Moa Point Road – outside 36 Moa Point Rd
- M2 Moa Point Road (passing place)
- M3 Queens Drive reserve
- M4 Courtts Street
- M5 Gaudin Street
- M6 Bridge Street opposite number 10
- M7 73 Ahuiriri Street
- M8 Bunker Way

- 56 The topography of the area varies. To the east past Mirimar the land rises above the golf course and there are direct views across the airport from the residential areas situated on Monorgan Road, Raukawa Street, Bunker Way, Kekerenga Street and Ahuriri Street. The closest dwellings to the existing threshold of runway 34 are the Moa Point dwellings, which overlook Lyall Bay and are approximately 310 m to the existing runway threshold. To the west of the airport across Lyall Bay there are dwellings located along Queens Drive, approximately 1.25 km distance to the existing runway 34 threshold. Further to the north along Lyall Parade there is a mixture of residential dwellings and commercial facilities at approximately 1 km from the existing runway 34 threshold. Immediately west of the northern and central sections of the airport there are retail / commercial units on Tirangi Road. Kingsford Smith Street is occupied with residential dwellings.
- 57 The remaining houses on the eastern side of Bridge Street⁷ (Numbers 17, 23, 47 and 63) are approximately 100-110 m to the runway centre line. On the western side of Bridge Street the dwellings are approximately 160 m from the runway centre. There are a number of earth bunds within the airport boundary which partially screen the main runway from these dwellings. However the elevated dwellings on Tirangi Road, overlook the main runway at a distance of approximately 200 m from the runway centreline.
- 58 The majority of homes are single storey in height and are weatherboard clad timber buildings with single glazed windows.

4.2 Receivers

- 59 Sensitive receivers are locations and/or buildings situated close to the proposed construction works which may be particularly affected by construction noise and/or vibration. These are listed in **Table 2**. Distances quoted to the runway are to the centreline of the runway. Distances quoted to the worksite are to the approximate location of construction plant which may sit outside the boundary of the worksite.
- 60 In general, receivers closest to the construction activities will be most affected and therefore assessing construction noise and vibration levels at those receivers also provides an indication of the maximum potential effect that may occur. As some works will more likely take place during the period when the airport is not operating, it is necessary to assess potential construction noise/vibration effects during all periods of the day and night.
- 61 Noise and vibration associated with the construction activities may also be perceptible to recreational users of Lyall Bay and Moa Point. Accordingly, five recreational receiver locations in these areas have been identified and included in **Table 2**.
- 62 **Figure 6** displays the noise calculation locations used in the construction noise assessment.

⁷ WIAL has a policy to purchase the most noise affected dwellings and has cleared certain sections along Bridge Street.

Table 2 Representative receivers

Type	Receiver	Distance in metres to:			
		Existing runway	Runway extension	Worksite closest proximity	Haul route
Residential	R1 - Moa Point	310	310	180	100
	R2 - Monorgan Road	900	1,400	1,360	420
	R3 - Raukawa Street	750	800	690	290
	R4 - Bunker Way	740	930	840	220
	R5 - Kekerenga Street	590	620	490	335
	R6 - Ahuriri Street	640	660	500	420
	R7 - Bridge Street	100-160	1,310	1,380	270
	R8 - Tirangi Road	200	1,200	1,370	440
	R9 - Lyall Parade	1,000	1,120	1,060	15
	R10 - Queens Drive	1,250	1,150	1,070	900
	Calabar Road (northern end)	195	2,000	1,980	35
	Calabar Road (southern end)	165	1,380	1,370	18
	Onepu Road	960	1,400	1,160	15
Commercial	R11 - Tirangi Road / Kingsford Smith Street	320	1,000	1,020	20
Recreational	Outdoor seating at Spruce Goose café	210	1,000	880	15
	Surfing activities and other users of Lyall Bay beach	220	900	840	30
	Plane spotters on Moa Point Rd	100	280	100	10
	Walkers on south coast	160	270	50	10
	Golf course (closest point)	384	485	340	30

Note – Receivers marked R1-R11 refer to those locations used in **Table 6** – construction noise calculations



Figure 6 Noise calculation locations

4.3 Noise surveys

- 63 Ambient noise was measured using an unattended sound level meter located at 36a Moa Point Road (L1) and at eight locations (M1-M8) surrounding the airport using attended measurements. During these attended measurements, aural observations were noted during the day and at night (post 2200h). See **Appendix B** for further details and below:

Personnel	Darran Humpheson and John Bull (AECOM)
Dates	9 March - 26 March 2015
Instrumentation	Long term EL 316 environmental noise logger at 36A Moa Point Road : Serial number 16-707-025 Attended Brüel & Kjær type 2250 : Serial number 2638850 Brüel & Kjær type 4231 calibrator : Serial number 2635932
Measurement sites	Long term (L1) – 36A Moa Point Road on deck in front of dwelling one metre from façade Attended measurements: M1 Moa Point Road – outside 36 Moa Point Rd M2 Moa Point Road (passing place) M3 Queens Drive reserve M4 Coutts Street M5 Gaudin Street M6 Bridge Street opposite number 10 M7 73 Ahuiri Street M8 Bunker Way
Microphone	1.2 m high (façade for unattended and free field for attended)
Field checks	Prior to and after the noise measurements a field check was performed, including a self-calibration of each logger. The difference in calibration levels were as follows : Unattended 0.3 dB & attended < 0.1 dB
Meteorological conditions	One hour logged data obtained from Wellington Airport – sourced from Wunderground.com

- 64 Daytime attended measurements were recorded on Monday 9 March 2015. Attended night time measurements were to be undertaken a week later during collection of the long term kit at 36A Moa Point Road, however very high winds and rain meant that a resurvey was required. This was undertaken on the night of Wednesday 25 March. A summary of the results of the short term survey is presented below in **Table 3** and **Table 4**.

Table 3 Summary of results 9 March 2015

Sites	Location	Description	Start time	Duration (mins)	L _{Aeq} (dB)	L _{AF10.0} (dB)	L _{AF90} (dB)	L _{AFmin} (dB)	L _{AFmax} (dB)	Noise sources
M1	Moa Point Road	Opposite layby on verge facing runway nearest shore line	12:44	30	64	65	53	49	84	Cars, aircraft, surf, sea gull, cicada
M2	Moa Point Road	Outside 36 and 36A, on pavement in line with long term monitor	13:19	30	63	62	44	40	87	Surf, cars, dog barking, aircraft
M3	Queens Drive reserve	Dorrie Leslie Park water front 10m from road opposite apartments	14:04	30	56	59	49	44	76	Cars, trucks, aircraft and some FH quarry working
M4	Coutts Street	Side of #244 on pavement by side of house	15:22	30	64	65	51	47	86	Aircraft, HEMS, ground running aircraft, demolition works on retail park
M5	Gaudin Street	Gaudin Street near Airways Power Centre by Access gate C, side of house 23	15:56	30	66	61	45	41	89	Aircraft, ground ops, cars
M6	Bridge Street	Opposite #10 on open area 2 m from pavement	16:28	15	63	62	42	39	85	Aircraft, road traffic, ground ops
M7	Ahuri Street	Near #73 by NMT compound	17:08	15	55	56	47	43	76	Cars, buses, ground ops from airport clearly audible, aircraft
M8	Bunker Way	Links View Estate	17:31	15	53	57	48	45	65	Aircraft ground ops, cars
M1	Moa Point Road	Opposite layby on verge facing runway nearest shore line	18:00	15	63	67	54	50	77	Cars, aircraft, surf, sea gull, cicada
M2	Moa Point Road	Outside 36 and 36 A, on pavement in line with long term monitor	18:19	15	63	66	43	38	81	Surf, cars, dog barking, aircraft

Table 4 Summary of results 25 March 2015

Sites	Location	Start time	Duration (mins)	L _{Aeq} (dB)	L _{AF10.0} (dB)	L _{AF90} (dB)	L _{AFmin} (dB)	L _{AFmax} (dB)	Noise sources
M1	Moa Point Road	00:20	15	38	41	33	29	51	No road or air traffic. Construction noise in distance just audible, more screening than M2.
M2	Moa Point Road	23:59	15	49	52	44	40	60	No road or air traffic. Waves. Construction noise in distance, continuous drone and cyclic rattle.
M3	Queens Drive reserve	00:48	15	43	45	40	37	53	No road or air traffic. Construction noise in distance just audible. Waves
M4	Coutts Street	02:57	15	38	41	33	31	56	No road or air traffic. Construction noise in distance just audible
M5	Gaudin Street	02:38	15	43	45	39	37	56	No road or air traffic. Construction noise in distance dominant
M6	Bridge Street	02:19	15	44	46	40	38	59	No road or air traffic. Construction noise in distance dominant
M7	Ahuri Street	01:52	15	48	52	41	36	61	No road or air traffic. Construction noise in distance dominant
M8	Bunker Way	01:29	15	38	39	34	32	57	No road or air traffic. Construction noise in distance

65 A summary of the long term data is detailed in **Table 5** based upon the NZS 6803 construction periods. Also included is the night time period when the airport is closed (0100h to 0600h). Graphical time history data showing

the variance in diurnal noise for complete 24 hour periods is included at **Appendix C**. The tabulated long term data clearly highlights that during the operational hours of the airport, the noise environment at Moa Point is dominated by aircraft activity. Between 0100h and 0600h noise levels reduce by an average of 20 dB when compared to normal daytime hours.

Table 5 Long term summary L_{Aeq} data (36A Moa Point Road – receiver location L1)

Time period	Tuesday 10-03-15	Wednesday 11-03-15	Thursday 12-03-15	Friday 13-03-15	Saturday 14-03-15	Sunday 15-03-15
0000h - 2359h	59	63	62	60	62	60
0630h - 0730h	59	66	66	63	66	64
0730h - 1800h	62	65	64	63	65	62
1800h - 2000h	59	65	64	63	60	64
2000h - 0730h	52	59	57	56	56	55
0100h - 0600h	43	41	46	37	47	45

- 66 Additional baseline survey data is available from the airport's noise monitoring terminal at 73 Ahuriri Street in Strathmore Park (M7). Data has been provided for the whole of 2014 to examine the long term variation of noise. The same time periods have been used to generate the graphs at **Appendix C**. As shown, there is a variance throughout the year between the different time periods. The greatest variance occurs when the airport is closed to scheduled aircraft between the hours of 0100h to 0600h, i.e. when airport noise does not dominate the daytime noise levels. This long term data has been used to assist with the assessment of construction noise effects.

5.0 Construction assessment

5.1 Assessment framework

- 67 As is normal for projects that are at the preliminary design stage, a contractor has not yet been appointed and specific construction plant and methodologies cannot yet be fully determined. Therefore, this report considers indicative construction activities to make a broad assessment of noise and vibration levels and to determine the extent of likely effects and whether those effects can be appropriately managed.
- 68 Once the plant and methodologies are confirmed by the contractor, a project specific CNVMP (and schedules) will be finalised and will detail specific mitigation and management measures that will be adopted. In the interim, a draft CNVMP has been prepared which identifies the main requirements and sets out the structure of the management plan (**Appendix F**).
- 69 Vibration effects from the project are not considered significant. There will be no piling or vibrocompaction near any residential areas (i.e. within 100 m). Potential vibration effects may arise as construction vehicles pass close to sensitive receivers, and only if there are significant irregularities in the road surface. Accordingly, vibration has been scoped out from this assessment, but has been included in the draft CNVMP.
- 70 The likely construction noise effects of the development have been assessed for each of the stages described in Section 2.1. Indicative construction plant sound levels and operating durations have been used for both daytime and night time working. An inventory of plant and associated sound levels is provided at **Appendix D**. Construction noise calculations have been undertaken using the method in NZS 6803 and do not take into account the effects of screening by local terrain, which in itself is a conservative assumption.
- 71 Whether construction truck movements from the quarries to the airport are likely to cause a significant effect is dependent upon the following factors:
- Level of noise generated both in terms of an average (L_{Aeq}) and also a maximum from the truck movements;
 - Level of existing road traffic noise (and other ambient) noise along the haul route; and
 - Sensitivity of the receiving environment along the route, ie residential dwellings and their proximity to the haul route;
- 72 The impact of the haul road noise was assessed using a combination of the construction noise standard NZS 6803, which uses the calculation procedures of BS 5228-1 and the UK Department of Transport and Welsh Office 'Calculation of Road Traffic Noise' (**CRTN**) procedure, which is referenced in NZS 6806:2010.
- 73 All of these assumptions will be updated once a contractor has been appointed and a project specific CNVMP has been prepared. Additional mitigation may also be practicable such as enhanced management procedures for example the use of temporary noise barriers or alternative plant and processes. Inclusion of these measures may reduce the predicted noise levels further. However at present, the construction noise levels are considered realistic estimates for assessing the likely effects of the project, particularly if land based materials are used.

5.2 Management framework

- 74 A draft CNVMP has been prepared by the Project team, and will be finalised and implemented by the appointed contractors. The plan includes:
- noise targets;
 - summary of assessments locations

- general construction practices, management and mitigation;
- a process for activity specific assessments (schedules);
- monitoring and reporting requirements;
- procedures for handling complaints; and
- procedures for review of the CNVMP throughout the Project.

6.0 Assessment of effects

6.1 Human response

- 76 Excessive noise can interfere with speech communication; it can interrupt a wide range of different types of work, particularly activities requiring sustained concentration; it can disturb rest and relaxation; and depending on the hours of operations it can disrupt normal patterns of sleep. Continuous high noise levels for extended periods of time can contribute to noise induced hearing loss, whilst at the generally lower sound levels typically found outside houses, residents often report varying degrees of annoyance. The WHO defines noise annoyance as 'a feeling of displeasure evoked by a noise'.
- 77 Reported annoyance is known to be affected by:
- noise level and nature of noise - including whether the sound is constant, fluctuating, impulsive (startle), has low frequency components (e.g. rumble/boom) or is high pitched (e.g. whine/whoosh); and
 - occurrence of exposure - reported annoyance varies depending on the frequency of events and whether they are anticipated or randomly occur;
- 78 The effects of noise are also dependent upon the time of day at which it occurs. This is due to acoustic factors, such as the relative level of background noise, and non-acoustic factors, such as the activities being disturbed and people's expectations of noise levels at different times of the day.
- 79 While the "loudness" of a noise is a purely subjective parameter it is commonly accepted that change in noise level of 3 dB is just perceptible, and an increase/decrease of 10 dB corresponds to a doubling/halving in perceived loudness.

6.2 Construction noise

6.2.1 Onsite generated noise

- 80 Construction noise calculations from onsite works have been undertaken at the representative receptors (R1-R11) listed in **Table 2** in accordance with the guidance of NZS 6803:1999. These calculations do not take into account any shielding from building structures or topography and exclude any noise benefit gained from local mitigation such as use of temporary noise barriers, orientation of plant, etc. The presented noise levels are therefore worst case.
- 81 For each residential location and construction stage (including site establishment) a prediction of the likely worst case construction noise level has been undertaken using the L_{Aeq} data listed at **Appendix A** and **Appendix D**.
- 82 A calculation of the maximum sound level is normally undertaken for those activities which are likely to generate impact type noise such as piling, or concrete breaking using percussive techniques. For this project there is only likely to be significant impact noise from possible stone column installation. Due to the large distances involved, maximum noise levels have not been calculated due to the resulting sound level being significantly below⁸ the NZS 6803 guideline values.
- 83 Activities which sometimes cause disturbance from maximum noise events often occur due to poor site management or operator behaviour. Example including dropping material from height instead, banging tipper

⁸ Based on the daytime NZS 6803 L_{Amax} of 85 dB and a distance between the source and receiver of 300m, the source level would have to be 115 dB at 10 m for an exceedance to occur (distance correction of 30 dB). Typical impact piling works generate levels of ~105 dB at 10 m. Hence it is unlikely that the project's L_{Amax} limits would be exceeded.

buckets against truck bodies or from poorly maintained equipment. Controls are proposed for these types of events as discussed later in this report.

- 84 Construction traffic effects are considered later in this section.
- 85 The calculated L_{Aeq} noise levels have then been compared with the guideline construction noise limits of NZS 6803 for works greater than 20 weeks in duration and the level of exceedance, if any, is also reported. The results are listed in **Table 6**. The main observations are:
- Weekdays works between 0730h to 2000h comply with the construction noise limits. Between 0630h and 0730h there is a minor exceedance of the 55 dB noise limit at Moa Point only by up to 4 dB.
 - All works comply with the construction limit of 70 dB between 0730h and 1800h on Saturdays.
 - There are exceedances within the night time period of 2000h to 0630h for Stages A, B, H, I, J and K, up to a maximum of 14 dB. The closest receptors at Moa Point being the most affected dwellings.
 - There are minor exceedances of the Sunday construction limit of 55 dB between 0730h and 1800h at the receivers at Moa Point.
- 86 These exceedances do not take into account potential noise mitigation measures which can either be additional management controls or physical/engineering controls. Potential enhanced mitigation measures are discussed in Section 7.0.
- 87 The indicative construction programme highlights that construction works could take place over a period of 48 months. If there were no project delays and there was maximum use of available maritime based transportation of fill material then it is likely that construction of the runway extension could be completed in a period of 36 months. Whilst it is acknowledged that NZS 6803 provides noise limits for projects greater than 20 weeks, a construction period of potentially 48 months is significant. Unlike other major project of this duration, such as nationally significant roading schemes, the runway extension works are concentrated in one area and not along a route corridor. Residents and other sensitive receptors could therefore experience more or less 'permanent' construction noise for up to 48 months. To address these potential effects, a combination of NZS 6803 and other assessment methods, such as noise change, have been used to assess the significance of the effects.
- 88 The extended worst case time frame is purely an artefact of the delays expected because of working within the constraints of the OLS and weather conditions within Lyall Bay. During these periods, construction works would not be ongoing and hence there would be respite from construction noise. In terms of effects there is a balance between completing projects quickly (i.e. more or less continuous noise) and ensuring that there is an element of relief. A balance has to be struck between providing relief to residents by having lulls in activity and maximising the available time to complete the work quickly and efficiently, which in this case is working within the constraints of the OLS and local weather conditions.
- 89 There may be occasions when different phases of the project are occurring simultaneously. Whilst concurrent working will accelerate the completion of the project, there would be additional noise generated and the effects of which are considered at section 6.5.

Table 6 Construction noise assessment

Task	Receiver	Predicted noise level	Comparison with NZ6803 criteria								
			Weekday	Weekday	Weekday	Weekday	Saturday & Sunday	Saturday	Sunday	Saturday & Sunday	Saturday & Sunday
		L _{Aeq} (dB)	0630-0730	0730-1800	1800-2000	2000-0630	0630-0730	0730-1800	0730-1800	1800-2000	2000-0630
Establishment - Site compound – Stage 0	R1	58 dB	Fails (+3dB)	Complies	Complies	Fails (+13dB)	Fails (+13dB)	Complies	Fails (+3dB)	Fails (+13dB)	Fails (+13dB)
	R2	45 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	50 dB	Complies	Complies	Complies	Fails (+5dB)	Fails (+5dB)	Complies	Complies	Fails (+5dB)	Fails (+5dB)
	R4	48 dB	Complies	Complies	Complies	Fails (+3dB)	Fails (+3dB)	Complies	Complies	Fails (+3dB)	Fails (+3dB)
	R5	52 dB	Complies	Complies	Complies	Fails (+7dB)	Fails (+7dB)	Complies	Complies	Fails (+7dB)	Fails (+7dB)
	R6	51 dB	Complies	Complies	Complies	Fails (+6dB)	Fails (+6dB)	Complies	Complies	Fails (+6dB)	Fails (+6dB)
	R7	45 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	46 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)
	R9	47 dB	Complies	Complies	Complies	Fails (+2dB)	Fails (+2dB)	Complies	Complies	Fails (+2dB)	Fails (+2dB)
	R10	47 dB	Complies	Complies	Complies	Fails (+2dB)	Fails (+2dB)	Complies	Complies	Fails (+2dB)	Fails (+2dB)
	R11	48 dB	Complies	Complies	Complies	Fails (+3dB)	Fails (+3dB)	Complies	Complies	Fails (+3dB)	Fails (+3dB)
Stage A	R1	54 dB	Complies	Complies	Complies	Fails (+9dB)	Fails (+9dB)	Complies	Complies	Fails (+9dB)	Fails (+9dB)
	R2	41 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	46 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)
	R4	45 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R5	48 dB	Complies	Complies	Complies	Fails (+3dB)	Fails (+3dB)	Complies	Complies	Fails (+3dB)	Fails (+3dB)
	R6	47 dB	Complies	Complies	Complies	Fails (+3dB)	Fails (+3dB)	Complies	Complies	Fails (+3dB)	Fails (+3dB)
	R7	42 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	42 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Stage B	R1	49 dB	Complies	Complies	Complies	Fails (+7dB)	Fails (+7dB)	Complies	Complies	Fails (+7dB)	Fails (+7dB)
	R2	36 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	41 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R4	40 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R5	43 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)
	R6	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R7	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	39 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies

Task	Receiver	Predicted noise level	Comparison with NZ6803 criteria								
			Weekday	Weekday	Weekday	Weekday	Saturday & Sunday	Saturday	Sunday	Saturday & Sunday	Saturday & Sunday
		L _{Aeq} (dB)	0630-0730	0730-1800	1800-2000	2000-0630	0630-0730	0730-1800	0730-1800	1800-2000	2000-0630
Stage C-D	R1	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R2	30 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	35 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R4	34 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R5	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R6	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R7	31 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	33 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Stage E	R1	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R2	31 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	36 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R4	35 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R5	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R6	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R7	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	33 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	33 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	34 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Stage F-G	R1	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R2	30 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	35 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R4	34 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R5	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R6	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R7	31 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	32 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	33 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies

Task	Receiver	Predicted noise level	Comparison with NZ6803 criteria								
			Weekday	Weekday	Weekday	Weekday	Saturday & Sunday	Saturday	Sunday	Saturday & Sunday	Saturday & Sunday
		L _{Aeq} (dB)	0630-0730	0730-1800	1800-2000	2000-0630	0630-0730	0730-1800	0730-1800	1800-2000	2000-0630
Stage H	R1	56 dB	Fails (+1dB)	Complies	Complies	Fails (+11dB)	Fails (+11dB)	Complies	Fails (+1dB)	Fails (+11dB)	Fails (+11dB)
	R2	42 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	47 dB	Complies	Complies	Complies	Fails (+2dB)	Fails (+2dB)	Complies	Complies	Fails (+2dB)	Fails (+2dB)
	R4	46 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)
	R5	49 dB	Complies	Complies	Complies	Fails (+4dB)	Fails (+4dB)	Complies	Complies	Fails (+4dB)	Fails (+4dB)
	R6	49 dB	Complies	Complies	Complies	Fails (+4dB)	Fails (+4dB)	Complies	Complies	Fails (+4dB)	Fails (+4dB)
	R7	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	45 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Stage I	R1	49 dB	Complies	Complies	Complies	Fails (+4dB)	Fails (+4dB)	Complies	Complies	Fails (+4dB)	Fails (+4dB)
	R2	36 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	41 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R4	40 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R5	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R6	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R7	37 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	38 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	39 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Stage J	R1	56 dB	Fails (+1dB)	Complies	Complies	Fails (+11dB)	Fails (+11dB)	Complies	Fails (+1dB)	Fails (+11dB)	Fails (+11dB)
	R2	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	48 dB	Complies	Complies	Complies	Fails (+3dB)	Fails (+3dB)	Complies	Complies	Fails (+3dB)	Fails (+3dB)
	R4	46 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)
	R5	50 dB	Complies	Complies	Complies	Fails (+5dB)	Fails (+5dB)	Complies	Complies	Fails (+5dB)	Fails (+5dB)
	R6	49 dB	Complies	Complies	Complies	Fails (+4dB)	Fails (+4dB)	Complies	Complies	Fails (+4dB)	Fails (+4dB)
	R7	43 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R8	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R9	45 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R10	44 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R11	46 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)

Task	Receiver	Predicted noise level	Comparison with NZ6803 criteria								
			Weekday	Weekday	Weekday	Weekday	Saturday & Sunday	Saturday	Sunday	Saturday & Sunday	Saturday & Sunday
		L _{Aeq} (dB)	0630-0730	0730-1800	1800-2000	2000-0630	0630-0730	0730-1800	0730-1800	1800-2000	2000-0630
Stage K	R1	59 dB	Fails (+4dB)	Complies	Complies	Fails (+14dB)	Fails (+14dB)	Complies	Fails (+4dB)	Fails (+14dB)	Fails (+14dB)
	R2	45 dB	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	R3	50 dB	Complies	Complies	Complies	Fails (+5dB)	Fails (+5dB)	Complies	Complies	Fails (+5dB)	Fails (+5dB)
	R4	49 dB	Complies	Complies	Complies	Fails (+4dB)	Fails (+4dB)	Complies	Complies	Fails (+4dB)	Fails (+4dB)
	R5	53 dB	Complies	Complies	Complies	Fails (+8dB)	Fails (+8dB)	Complies	Complies	Fails (+8dB)	Fails (+8dB)
	R6	52 dB	Complies	Complies	Complies	Fails (+7dB)	Fails (+7dB)	Complies	Complies	Fails (+7dB)	Fails (+7dB)
	R7	46 dB	Complies	Complies	Complies	Fails (+1dB)	Fails (+1dB)	Complies	Complies	Fails (+1dB)	Fails (+1dB)
	R8	47 dB	Complies	Complies	Complies	Fails (+2dB)	Fails (+2dB)	Complies	Complies	Fails (+2dB)	Fails (+2dB)
	R9	47 dB	Complies	Complies	Complies	Fails (+2dB)	Fails (+2dB)	Complies	Complies	Fails (+2dB)	Fails (+2dB)
	R10	47 dB	Complies	Complies	Complies	Fails (+2dB)	Fails (+2dB)	Complies	Complies	Fails (+2dB)	Fails (+2dB)
	R11	48 dB	Complies	Complies	Complies	Fails (+3dB)	Fails (+3dB)	Complies	Complies	Fails (+3dB)	Fails (+3dB)

6.2.2 Comparison with ambient noise

- 90 In certain situations, construction noise can be masked by high levels of ambient noise which is especially the case for noise sensitive receivers close to an airport or a busy state highway for example. Conversely, when ambient noise levels reduce, construction noise can be the most dominant source of noise.
- 91 The predicted construction noise levels have been compared with the measured ambient noise data presented in **Appendix C**. A noise change assessment has been undertaken, which assesses the increase in overall noise level (construction plus existing ambient noise) above the measured existing ambient noise level.
- 92 The two closest receiver locations have been assessed with the baseline noise data measured at 36A Moa Point Road. The results are presented in **Table 7**. Where there is no noise change indicated in the table, the existing ambient noise level is above the predicted construction noise level by at least 10 dB, hence there is no increase in the overall noise level. There has been no assessment of site establishment works during the period 2000h-0730h as these works would not take place at night.
- 93 The greatest noise change occurs during the night time period of 0100h-0600h when the airport is not operational for scheduled aircraft movements. During this period when ambient noise levels are at their lowest, construction noise may be audible. NZS 6803 does allow the night time noise limits to be relaxed if ambient noise levels are relatively high e.g. 60 dB L_{A90} , however for this particular project, existing noise levels at night are low such that noise mitigation measures would have to be implemented. As the night time noise limits of NZS 6803 are recommended to prevent sleep disturbance there are a number of mitigation measures that can be introduced to minimise any adverse disturbance. Further details are provided in Section 7.0.

Table 7 Construction noise change

Receptor	Period	Noise increase (dB) by work stage									
		0	A	B	C-D	E	F-G	H	I	J	K
R1 Moa Point	0630-0730	3	1	-	-	-	-	2	-	2	3
	0730-1800	1	1	-	-	-	-	1	-	1	2
	1800-2000	3	1	-	-	-	-	2	-	2	3
	2000-0730	NA	4	2	1	1	1	5	2	5	8
	0100-0600	NA	13	9	4	5	4	15	9	15	18
R5 Kekerenga Street	0630-0730	1	-	-	-	-	-	-	1	1	1
	0730-1800	-	-	-	-	-	-	-	1	-	1
	1800-2000	1	-	-	-	-	-	-	1	1	1
	2000-0730	NA	1	1	-	-	-	2	4	2	4
	0100-0600	NA	8	4	1	2	1	9	12	10	12

Highlighted cells indicate those work stages / time periods when the cumulative noise is likely to be perceptible. Those cells in dark highlighting would experience a significant increase in noise – see Section 6.5.

- 94 The 2014 long term noise data from the permanent noise monitor does show that there is a wide variation in noise levels at night, such that there would be situations when construction noise may be not as dominant due to elevated levels of background noise, e.g. surf and wind noise. However, during these periods it is likely that the sea state conditions would mean that certain activities would not occur due to adverse conditions. Hence the assessment presented above is considered to be a likely worst case of construction noise effects.

6.2.3 Construction traffic offsite

- 95 Previous work used to inform the community consultations process undertaken by WIAL was based on a maximum of 60 truck movements per hour, i.e. 120 two way movements. The noise assessment concluded that during the day, noise was not a determining factor due to the high levels of existing ambient noise. However during the evening and especially at night, truck movements were likely to result in a clearly perceptible increase in the noise environment along the originally proposed route and this affected the ability to undertake haulage during the night-time period. Following the consultation period and feedback received from residents along the originally proposed route the impacts of construction vehicles was revisited and a revised assessment was undertaken. Greater certainty was provided with respect to the quantities of land based fill material that could be hauled and the ability to use the airport precinct as a route during the night time period. These changes not only resulted in amended inbound and outbound routes but also changes to the number of vehicle movements. Further information is provided below and in the Transport Assessment report prepared by TDG.

Background

- 96 During public consultation residents living along Bridge Street and the short section of Coutts Street between Bridge Street and Tirangi Road in particular, raised concerns with the proposed haulage route. There was concern about potential noise and amenity effects arising from increased traffic movements in this area of mainly local roads. In light of this feedback, WIAL commissioned TDG to further assess alternative haulage route options in and around the Airport site, as well as AECOM to assess the potential effects arising from traffic noise along the identified routes.
- 97 An assessment into night time only haulage of material via the main arterial routes through the city and into and out of the construction site via SH1 (Stewart Duff Drive) was initially considered. While this was viable from a traffic perspective, noise effects along some of the inner city residential routes were not considered to be acceptable and the number of dwellings affected made mitigation to address these effects impractical.
- 98 Following this, further analysis was undertaken by the project's engineers and traffic consultants into the likely traffic numbers, including how much material could be stockpiled at the construction site. This work identified that a reduction in the number of heavy vehicle movements to and from the site would be achievable.
- 99 Noting this reduction in weekly movements, TDG and AECOM then reviewed the current capacity and constraints on the existing roading network, on an hourly basis, to determine how these weekly movements might be accommodated on a daily and hourly basis. Specifically, the potential noise impacts of trucks and trailers passing through residential areas on a 24 hour basis, while TDG reviewed the existing traffic flows to determine where and when in the network space capacity existed. This combined review concluded that a reasonably upper limit of 310 trucks per day to the site could be accommodated, with a maximum of 160 truck movements occurring at night time along SH1 (and to and from the site via Stewart Duff Drive) and a maximum of 150 trucks during the day time, with inbound movements occurring via SH1 and outbound movements via Moa Point Road, Lyall Parade, Onepu Road and Evans Bay Parade linking back to SH1 at the Evans Bay Parade lights. This presented a suitable option from both a traffic and noise perspective, with appropriate limitations as to the number of heavy construction vehicles occurring each hour being more restrictive during night time hours, and avoidance of peak commuter times, and weekends.

Assessment

- 100 The impact of construction vehicles using the routes shown in **Figure 2** has been assessed using the calculation procedures of the UK's CRTN. Based on traffic data supplied by TDG, the construction routes have been broken down into 8 segments and the noise effects over a construction day have been assessed in more detail. The existing traffic noise was calculated using CRTN and the input parameters are shown in **Table 8**. The $L_{Aeq, 1hr}$

values were calculated using the method given by the UK's Transport Research Laboratory (TRL), this is summarised in Equation 4.4 from TRL⁹.

Table 8 CRTN parameters

Parameter	Value
Traffic flow	As supplied in hourly increments by TDG
Percentage heavy vehicles	3% for existing traffic as provided by TDG
Speed	50 km/hr for all roads
Gradient	0% for all roads
Road surface correction	0 dB for all roads (assumes Asphaltic Concrete)
Receiver height	1.5 m for all receivers
Ground absorption	0.3 to account for absorption.

Night time assessment

- 101 An initial screening exercise was undertaken to assess the effects of night time (2200h to 0600h) construction vehicle movements along the proposed haulage route. Based upon advice from the project team it was assumed that there would be an estimated 26 construction vehicles (trucks and trailers) equating to 56 two-way movements per hour at night based upon the estimated quantities of material to be moved by road and the construction programme assuming no marine fill. Accordingly, this hourly movement number was applied to each hour between 2200h and 0600h together with the corresponding existing traffic movements during the same hourly periods. The inbound and outbound routes between the two quarries and SH1 are the same except for Vivian Street and Arthur Street where there is one-way traffic. The 8 route segments are summarised in **Table 9**.

Table 9 Road segment details (night time)

Road segment	Description	Haulage Vehicle Types
Hawkestone Interchange	State Highway 1 north of Terrace Tunnel	Both
Terrace Tunnel	Through Terrace Tunnel to Hawkestone Interchange.	Both
Arthur Street	Rugby Street and Sussex Street around The Oval. Then onto Arthur Street to the Terrace Tunnel.	Un-laden
Vivian Street	Vivian Street and Cambridge Terrace	Laden
Paterson Street	Paterson Street through tunnel	Both
Ruahine Street	Ruahine Street between Wellington Road and Paterson Street	Both
Cobham Drive	Cobham Drive between Ruahine Street and Calabar Road	Both
Calabar Road	Calabar Road and Stewart Duff Drive	Both

- 102 From the results of the assessment the number of dwellings¹⁰ potentially affected by the project in 10 m distance bands from 0 to 50 m from the road centreline have been determined. This assessment is independent of the

⁹ $L_{Aeq,1h} = 0.94 \times L_{A10,1h} + 0.77$ dB - taken from TRL report Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping, PG Abbott and P M Nelson PR/SE/451/02 2002.

¹⁰ GIS screening assessment does not fully consider dwellings which may be shielded by other buildings ie the assessment simply relies on those address points within set distances from each road. From examination of mapping data a cut-off distance of 30 m may be appropriate to consider the effects of the project as the majority of buildings at distances greater than 30m are shielded by closer buildings and hence any noise effects would be much lower than those closer to the roads.

project's noise levels and simply estimates the number of dwellings within the distance bands. Only the night time route has been considered as this is the most noise sensitive route.

103 One hour noise levels throughout the construction day and night have been calculated for the following scenarios:

- Overall CRTN level along the route based on the traffic data for each road segment (existing noise level);
- Construction traffic noise level for each route (project noise level);
- Combined existing and project noise level; and
- Noise change between existing and project noise level

104 **Appendix E** provides tabulated and graphical data for the above analyses together with plans showing the location of the identified noise sensitive receptors (dwellings).

105 The data was then compared against the thresholds of 45 dB $L_{Aeq(1hr)}$ and 70 dB L_{AFmax} and the 3 dB perceptible threshold criteria discussed in Section 53.

House Counts

106 Noise sensitive receptors are located within close proximity to the night-time construction vehicle route, particularly along Vivian Street and Arthur Street. **Table 10** summarises the combined number of dwellings (estimated) within the 10 m distance bands. In total there are around 2,670 dwellings within 50 m of the proposed haulage route that could be affected by construction traffic at night. However the significance of the effect is dependent upon the level of noise likely to be received at the residential façade and the degree of the audible change as discussed below.

Table 10 Approximate number of dwellings along the night time haulage route

Distance band	Number of dwellings
0	20
10	320
20	190
30	220
40	270
50	1,650

Existing road traffic noise levels

107 The CRTN assessment (**Appendix E**) has established the variation in existing noise level based upon a standardised distance of 10 m from the centre line of each road. Typically $L_{Aeq,1hr}$ existing noise levels at 10m along the haulage route are in the range 56-67 dB at the façade of the house. Based on the data in Table 10 approximately 340 dwellings are exposed to these noise levels.

108 Dwellings greater than 30 m are likely to be shielded by other buildings which have not been taken in to consideration in the GIS screening exercise. Approximately 530 dwellings may be exposed along the haul route and at this distance noise levels will be above 45 dB $L_{Aeq(1hr)}$ at the building's façade.

109 According to WHO and NZS 6802, with windows open, there is the potential for sleep disturbance effects from existing road traffic flows at night along the haulage route. With windows closed (standard timber weatherboard house), potential sleep disturbance effects are likely if noise levels are greater than 60 dB (based on a façade

reduction of 30 dB from outside to inside and a target internal noise level of 30 dB). Again existing noise levels are likely to exceed this level within approximately 30 m of the haulage route specifically during the period 2200h to 0000h and 0400h to 0600h, i.e. the shoulder hours of the night time period.

Future road traffic noise levels

- 110 With the project's construction traffic, predicted road traffic noise levels at night will also be above the relevant noise levels with windows open and with windows closed. Since there are 'identical impacts', i.e. exceedances of the façade noise levels with and without the construction traffic the significance of the effect is very much dependent upon the change in noise level, i.e. how much an increase is likely to occur and also whether the character of the sound is the same, i.e. more of the same or the introduction of a completely new noise source.
- 111 For both existing and project traffic, maximum noise levels from vehicle movements will be greater than 70 dB L_{AFmax} since a car travelling at 50 km/h at a distance of 10 m will produce a L_{AFmax} of approximately 72 dB. Service vehicles and the like can produce maximum noise levels of approximately 82 dB L_{Amax} at 10m. Measured maximum noise levels from quarry trucks both laden and unladen are less than the noise generated by service vehicles. However, increased noise can be produced if the road surfaces are such that there is banging and rattling of the vehicle bodies as they pass over any irregularity in the roads, e.g. pot holes. It will therefore be important to ensure that the serviceability of the road surfaces is maintained throughout the construction programme.

Noise level change

- 112 Notwithstanding any audible characteristics which a noise source may have, a 3 dB change in the overall noise level is considered to be just perceptible. A 10 dB increase is considered a subjective doubling of the loudness of the sound. Anywhere between 3 dB and 5 dB would be considered a minor change and between 5 dB and 10 dB a moderate change. Greater than 10 dB would be considered a major change.
- 113 **Table 11** provides an indication of the maximum predicted noise change in each hour with the addition of the initial screening exercise's 28 vehicles per hour at a standardised distance of 10 m from the haul route. As can be seen, the change in noise level ranges from 1 to 7 dB, with the greatest increases as one would expect during the early hours of the night (0100h to 0300h). Those time periods highlighted would experience a moderate increase in the overall noise level.

Table 11 Predicted noise change along construction haul route

One hour period starting	Noise change / $L_{Aeq, 1h}$							
	Hawkestone Interchange	Terrace Tunnel	Arthur Street	Vivian Street	Paterson Street	Ruahine Street	Cobham Drive	Calabar Road
10pm	1	1	1	1	1	3	1	3
11pm	2	2	1	2	2	3	2	3
12am	2	2	2	2	2	3	2	2
1am	3	3	2	3	3	4	3	4
2am	4	4	3	4	4	5	5	6
3am	3	3	3	3	3	5	3	4
4am	3	3	2	2	2	3	2	2
5am	2	2	2	1	1	2	2	2
6am	1	1	1	1	1	3	1	3

- 114 Following refinement of the required vehicle movements a further analysis was undertaken whereby the number of vehicles required to achieve a 3 dB or less noise change at a standardised distance of 10 m was calculated. This approach effectively established the maximum number of vehicle movements that could be operated on the night time haulage route based upon whether the resulting noise change is considered acceptable. The results of the assessment are shown in **Table 12**.

Table 12 Maximum number of construction vehicle movements to achieve a 3 dB change in noise level.

One hour period starting	Hawkestone Interchange	Terrace Tunnel	Arthur Street	Vivian Street	Paterson Street	Ruahine Street	Cobham Drive	Calabar Road
10pm	30	30	30	30	30	30	30	30
11pm	30	30	30	30	30	25	30	30
12am	30	30	30	30	30	25	30	30
1am	30	30	30	20	30	15	25	20
2am	15	15	20	15	15	5	10	5
3am	25	20	20	30	30	10	25	20
4am	30	30	30	30	30	20	30	30
5am	30	30	30	30	30	30	30	30

- 115 Ruahine Street is the controlling road with respect to construction vehicle movements and following consultation with TDG a diurnal pattern of construction vehicle movements, as shown in **Table 13**, was developed. The daytime hours are constrained due to normal traffic conditions at intersections, whereas the night time period is noise limited, i.e. a 3 dB or less increase in road-traffic noise. As shown in the table the most sensitive noise period is from 0100h to 0400h. In the most noise sensitive hour there can only be a maximum of 5 vehicle movements (10 two-way movements).

Table 13 Maximum construction vehicles per time period

One hour period starting	In/out via State Highway 1	Airport (clockwise) loop	L _{Aeq} (1hr) Unladen @ 10m	L _{Aeq} (1hr) Unladen @ 10m	L _{Aeq} (1hr) Combined @ 10m
9.30-10 am	-	15	41	41	44
10am	-	30	47	50	52
11am	-	30	47	50	52
12 noon	-	30	47	50	52
1pm	-	30	47	50	52
2-2.30 pm	-	15	41	41	44
10pm	30	-	47	50	52
11pm	25	-	46	49	51
12am	25	-	46	49	51
1am	15	-	44	47	49
2am	5	-	39	42	44
3am	10	-	42	45	47
4am	20	-	45	48	50
5am	30	-	47	50	52

- 116 The table also provides an indication of the hourly construction vehicle L_{Aeq} based upon a standardised distance of 10 m from the haulage route. The data is based on the information measured and reported in **Appendix E**. At greater distances the noise level will reduce, for example at 30m the reported noise levels would be approximately 5 dB lower than those presented in **Table 13**.
- 117 Provided that the haulage vehicle numbers detailed above are adhered to then the adverse effects on residential receptors along the haulage routes would be mitigated to an acceptable level.

Character of the sound

- 118 Construction traffic and large vehicles, including service vehicles, road sweepers and the like, already use the haul route throughout the day and night albeit that the magnitude of the movements is not identical nor is the duration of the project. Construction traffic can have clearly perceptible characteristics compared with other traffic if:
- The driver is accelerating hard or using engine braking (driver behaviour);
 - The body of the vehicle is loose so it rattles and bangs when travelling over irregularities in the road; and
 - The vehicle is reversing and has tonal warning alarms instead of being fitted with less intrusive broad band alarms.
- 119 Wellington City Centre and the majority of the haul route is a state highway or principal road and there can be an expectation that road traffic noise will be audible even at night. Therefore provided that the vehicles are well maintained (as should be the road surface), driven in a reasonable manner the likelihood of any adverse audible characteristics is diminished.
- 120 Supporting information is provided in the transport assessment prepared by TDG, including the draft Construction Traffic Management Plan (**CTMP**). Further mitigation suggestions are included in Section 7.0.

6.3 Marine impacts

- 121 In addition to noise effects above water there is also the potential for disturbance and impact to the marine environment. Underwater sound can cause disturbance to noise sensitive marine species including marine mammals. Typical effects include changes in behaviour such as avoidance of areas where noise is being generated.
- 122 Construction activities will generate noise within the water column during the reclamation process. The most significant activity will be when inserting stone columns (if required) in the sea bed and reclamation area. This assessment has assumed that piling will also occur for temporary mooring purposes and potentially for a wave barrier.
- 123 There are standard procedures for minimising the effects on marine mammals, which have been proposed by the Department of Conservation. Whilst these procedures are applicable when undertaking seismic surveying, some of the procedures could be applied to this project, i.e. record keeping of marine mammal sightings, use of acoustic deterrents or avoiding any noisy works if and when marine mammals are spotted within certain distances of the work area. All of these measures will assist with minimising any adverse effects on any marine mammals.

6.4 Recreational receivers

- 124 There are a number of recreational receivers present in the Lyall Bay area that may be exposed to noise associated with the runway extension construction activities. Specific receivers have been identified and are described in the assessment of effects on recreation report¹¹.
- 125 Recreational users will generally only be present during daytime hours and, unlike residents, are transient users. During these times there is a relatively high level of ambient noise from non-construction related noise sources. Daytime noise measurements made at Moa Point on 9 March 2015 gave noise levels of 63-64 dB L_{Aeq} over the 30 minute measurement periods, and 84-87 dB L_{AFmax} for individual aircraft movements. The other noise sources at this location included road traffic, aircraft and surf.
- 126 Noise predictions have been conducted in accordance with the guidance of NZS 6803:1999 for the runway extension activities and haul route traffic (Section 6.0). The range of noise levels from all the construction stages are summarised in **Table 14**.

Table 14 Predicted noise levels for recreational receivers

Receiver	Predicted noise level, $L_{Aeq, 1hr}$ dB	
	Runway extension	Haul route
Outdoor seating at Spruce Goose café	33-48	54
Surfing activities and other users of Lyall Bay beach	34-49	49
Plane spotters on Moa Point Rd	44-59	54
Walkers on south coast	45-60	58
Golf course	35-48	56-38

- 127 In certain situations, construction and haul route traffic noise will be masked by high levels of ambient noise. This is especially the case for the receivers close to the sea and runway, e.g. surfers and beach-goers in Lyall Bay, and plane spotters on Moa Point Road. Should ambient noise levels reduce, construction related noise can become the most dominant source of noise, e.g. during calm weather conditions and limited aircraft activity, or lulls in vehicle movements.
- 128 The character of the construction and haul traffic noise will mean that it may be noticeable even in periods of relatively high ambient noise; however, the levels are not considered significant enough to provoke widespread annoyance amongst recreational users of the areas.
- 129 Noise from the haul route will be most noticeable to recreational users immediately adjacent to the route (which includes cyclists and pedestrians), which will predominantly be patrons of the Spruce Goose café and plane spotters sitting in their vehicles. At the café, construction vehicles will pass along the road unladen at a frequency of approximately one every two minutes during haulage periods. Trucks will not be accelerating or decelerating and therefore construction vehicle noise will be at the lower end of the expected range of levels and will be comparable to other large vehicles such as delivery vehicles servicing the local commercial areas. At the Moa Point Road carpark the noise environment will be dominated by aircraft take-offs and landings.
- 130 Construction related noise at the Spruce Goose café will be below ambient noise levels, with the dominant noise source being aircraft activity. Patrons of cafés and restaurants in the area will be used to the elevated levels of

¹¹ Wellington International Airport Proposed Extension – Assessment of Effects on Recreation. TRC Tourism.

noise associated with an operating airport, and can be expected to be tolerant of construction noise audible during lulls in airport activity.

- 131 Walkers on the south coast at Moa Point and cyclists may experience elevated noise levels when immediately adjacent to the haul road; however, the haul traffic noise will quickly decrease as the walkers move away from the road and as vehicles pass. At the closest locations to the haul road, noise from individual truck pass-bys will generally be below the noise level associated with an aircraft take-off or landing.
- 132 Users of the golf course will specifically experience construction vehicle noise at varying levels depending upon their proximity to the haulage route. The noise levels generated are not considered likely to disrupt golfers when compared to the noise of aircraft movements.

6.5 Combined effects of construction noise

- 133 The indicative construction programme indicates that certain phases of the project could be undertaken concurrently. In these situations there would be combined noise from some of the construction phases, which could result in additional noise (i.e. additive noise). Generally speaking construction noise levels at receivers will be dominated by the closest activities, and any increase in noise at an individual receiver will be minimal.
- 134 The ambient noise data also allows an assessment of cumulative noise effects, i.e. construction noise additive to the existing noise environment. The above assessment has included consideration of these cumulative effects by undertaking a noise change assessment. For construction vehicles during the day the calculated noise change is less than 2 dB and at night a maximum noise change of 3 dB has been set as the threshold of acceptability. Whilst there will be situations when there is elevated levels of noise and audible construction noise the focus will be to manage the effects of the construction phases to ensure that the resulting noise is mitigated to an acceptable level.

7.0 Construction noise mitigation

7.1 Overview

- 135 An assessment of the likely construction effects arising from the runway extension project has been undertaken with the expectation that the presented construction plant and processes reflect the best available equipment and techniques. The construction vehicle assessment has established maximum allowable vehicle movements based on whether there would be a perceptible increase in the hourly L_{Aeq} as a result of the project at dwellings along the haul routes. For daytime hours, noise is not a determining factor for construction vehicle movements.
- 136 The construction noise effects reported previously would be mitigated to an acceptable level. Key to the management of construction noise is the adoption and implementation of a CNVMP.

7.2 Construction Noise and Vibration Management Plan (CNVMP)

- 137 The project's CNVMP will set out the roles and responsibilities for managing construction noise throughout the project. Whilst the CNVMP will be a WIAL document, the contractor will be responsible for ensuring that the CNVMP is correctly implemented.
- 138 Any noise effects arising from the runway extension project will be mitigated as far as practicable using typical management and operational practices. These measures will be outlined in the CNVMP. A draft outline CNVMP is included at **Appendix F**, which sets out the proposed best practice approach to construction noise management.

- 139 Once a contractor has been appointed and the construction methodology finalised (including any consent conditions), noise predictions will be performed for significant activities and included within separate schedules (as required by the CNVMP). The schedule will identify the potentially affected neighbours and confirm the proposed methodology and plant to be used, along with specific mitigation (as outlined below). Standard mitigation will also be adopted, including:
- Engagement – WIAL in conjunction with the contractor will implement a stakeholder engagement management plan which will include informing affected stakeholders and provide regular information on the status of the project.
 - Monitoring – to ensure that the project's construction noise limits are being met, noise monitoring will be undertaken at relevant locations throughout the construction programme. Monitoring reports will be prepared which will highlight the effectiveness of noise control measures and what actions, if any, may need to be undertaken to respond to any noise related complaints.
- 140 Construction works are a regular activity at the airport and often occur at night. For example, there has been recent repaving of taxiways and past re-pavement works conducted on the main runway and it is understood from WIAL that they successfully managed with minimal noise issues. These pavement works can only be scheduled at night and WIAL has successfully managed to carry out these works with minimal disruption to its nearest neighbours. However the runway extension project will occur over a period of approximately 48 months and specific mitigation above and beyond normal contractor and client best practice is therefore required.

7.3 Further mitigation options

- 141 The project will aim to minimise works during the most noise sensitive periods, i.e. night time working. However there will be occasions when it is necessary to implement additional mitigation to allow certain activities to occur and a number of options are available.
- 142 The most affected dwellings are those at Moa Point where there is both proximity and an uninterrupted view from each dwelling to the construction area therefore the available options to mitigate against noise, specifically during the period when the airport's runway is closed for domestic and international aircraft are:
- Use of shielding: noise barriers can often be effective for screening work areas or noise sensitive areas. In this situation the barriers would have to be placed near the dwellings, which would be an impracticable solution.
 - Temporary rehoming: roading projects and night time infrastructure works occasionally rehouse householders temporarily during construction works. Often the rehoming is for a period of a few weeks during the busiest and noisiest period of the works. For this project it may be a practicable option but the overall duration of the works could mean a significant period of rehoming.
 - Sound insulation of dwellings: installation of acoustic, double or secondary glazing and provision of mechanical ventilation to negate the need to open windows at night. WIAL's LUMINS scheme (Land Use Management and Insulation for Airport Noise Study) recommends the sound insulation of aircraft noise affected dwellings to achieve an internal noise level of L_{dn} 45 dB. The Moa Point dwellings current qualify for mechanical ventilation (with limited additional treatment, i.e. but excluding enhancement of windows). This allows residents to keep windows closed whilst still achieving acceptable levels of ventilation. The standard LUMINS package of works would also satisfy the construction noise sound insulation requirements for the Moa Point dwellings.
 - Offer by WIAL to purchase the dwellings on a willing buyer willing seller basis once this project is confirmed.
 - Implementation of a project CTMP to help minimise the impact of construction traffic, which will include:
 - pre and post construction pavement condition surveys including reporting of road degradation by drivers;
 - compliance with speed restrictions;

- reminders of courteous and safe driving;
- engine braking restrictions; and
- use of temporary traffic management

7.3.1 Construction liaison group

143 WIAL has in the past formed a Construction Liaison Group with representative group members, such as contractor(s), community groups, council officers, etc. In the case of the recent RESA works the objectives of the group were:

- Establish ways to minimise any adverse effects of the construction process on adjacent communities. Matters upon which the Group reported included: the construction transport management plan, noise and dust minimisation, lighting, landscaping, and other related aspects.
- Provide input into the design of the landscaping plan that will be completed as part of construction (this was a co-operative initiative between the Construction Liaison Group and WIAL).
- Ascertain likely times and duration of night time construction work, likely traffic disruption and establish a reasonable means of communication with affected persons.
- Establish a procedure for liaison, in particular with the Airport, in the event of an emergency at the northern end of the runways and the need for traffic to be restored to two-way on Moa Point Road.
- Consider appropriate remedial actions if construction works generate dust at levels that constitute a nuisance to local residents.
- Discuss suitable content and form for dissemination of information to the public.
- Formulate appropriate contingency plans in the event that the effects of RESA construction are so severe as to make Moa Point houses uninhabitable.
- Assist WIAL in monitoring the effects of the construction period and monitoring the contractor's compliance with the conditions of consent relating to the construction work.

144 A similar group will be formed for the proposed runway construction works and in combination with the CNVMP and available mitigation options, any adverse effects from construction works will be mitigated to an acceptable level.





8.0 Conclusions



- 145 AECOM has identified likely construction activities associated with the runway extension project at Wellington Airport. Many activities will produce noise of similar levels to existing airport noise during operational hours. At certain stages of construction, during the night time period of 0100h-0600h when the airport is closed for scheduled aircraft movements, construction noise will be significant at certain times of the construction project without appropriate management and operational controls.
- 146 The principal contractor will be required to finalise a Construction Noise and Vibration Management Plan and Construction Environment Management Plan. Regardless of compliance with any criteria, best practices should always be adopted to minimise any unnecessary noise.
- 147 The airport in conjunction with the contractor will form a Construction Liaison Group to discuss environmental issues raised by the construction process. The group will also consider construction vehicle impacts both in terms of noise and transport related matters.
- 148 Where practicable adverse construction noise effects will be mitigated by management and onsite measures to an acceptable level. Where adverse impacts are predicted offsite, WIAL will also consider a range of specific mitigation options for the most affected dwellings.





Appendix A




Plant Description

Appendix A Plant Description

Land-based			
Plant Type	Activity	Location / duration	Sound Pressure Level / dB(A) @ x metres
Trucks 	Tipper trucks and trailers for end dumping rocks, quarry runs, structural fill, surcharge information etc. Primarily used during Stages C, H and K.	Will use haul routes from quarry / stockpiling area to work site. Throughout entire duration of works including reclamation and paving of runway.	70 dB L_{Aeq} at 10 m (unladen) 75 dB L_{Aeq} at 10 m (laden) 80-82 dB L_{Amax} at 10 m Similar level for all trucks including concrete deliveries
Long Arm Excavator 	For placement of batter filter material and Rock Primary and Secondary Armour. Used during Stages D, E and H.	Will be confined to reclamation area	Idling 52-68 dB L_{Aeq} Loading / unloading 79 dB L_{Aeq} General rock and earthwork placement 70-80 dB L_{Aeq} all at 10 m
Stone Column Rig 	Stone column insertion. Requires a loader to insert stone into hopper and concrete pump. Generates noise and vibration within the ground during vibro-compaction. Used during Stage H	For reclamation fill	82 dB L_{Aeq} at 10 m
Piling Rig 	Impact and vibratory piling rig either steel piles or concrete piles. Potentially to be used during reclamation works during Stage H		Vibratory 88 dB L_{Aeq} Impact 89 dB L_{Aeq} all at 10 m

Land-based			
Plant Type	Activity	Location / duration	Sound Pressure Level / dB(A) @ x metres
Dozer 	Stage K	New runway and taxiways and roads	81 dB L_{Aeq} at 10 m
Grader 	Stage K	New runway and taxiways and roads	78 - 81 dB L_{Aeq} at 10 m
Roller 	Stage K	New runway and taxiways and roads	Vibrating 67-77 dB L_{Aeq} at 10 m
Paving Plant 	Stage K	New runway and taxiways and roads	Asphalt paver 75-77 dB L_{Aeq} at 10 m

Marine-based			
Plant Type	Activity	Location / duration	Sound Pressure Level / dB(A) @ x metres
Clam Shell Dredge 	Dredging and handling rock and rock placement Only operates in calm conditions	Work Area : within protected area. Stage H	77dB L _{Aeq} at 20 m Cat345B loader with clamshell bucket
Stone Columns Barge 	Installation of Stone Columns using a standard barge with crane stone column rigs. Can also be used for installation of armour stone, geotextile and accropods	Stage A	71 - 77 dB L _{Aeq} at 10 m
Jack-up Barge 	Installation of Stone Columns using a jack-up barge with crane rig for stone column installation and impact piling rig.	Stage A	Barge mounted cranes
Long Arm Digger 	Long Arm Digger on barge for the movement and placement of materials underwater and for unloading off Hopper barges	All stages Can also be used for dredging (in protected water).	71 - 77 dB L _{Aeq} at 10 m

Marine-based			
Plant Type	Activity	Location / duration	Sound Pressure Level / dB(A) @ x metres
Cutter Suction Dredge 	Cutter Suction Dredge For winning fill material from borrow pit areas for reclamation fill	Stage H This requires relatively calm water to work, and the fill area must be a reasonable distance from the dredge area.	Estimated 77 dB L _{Aeq} at 10 m
Split Hull Barge 	Split Hull barge for transporting and bottom dumping reclamation fill. Most likely to use quarry run material loaded from a land dock and delivered to site.	Stages H and K	Estimated 75 dB L _{Aeq} at 10 m
Barge Discharge Fill 	Barge discharge for reclamation fill	Stage H	Estimated 77 dB L _{Aeq} at 10 m

Miscellaneous



Tug boat – 85 dB L_{Aeq} at 20 m

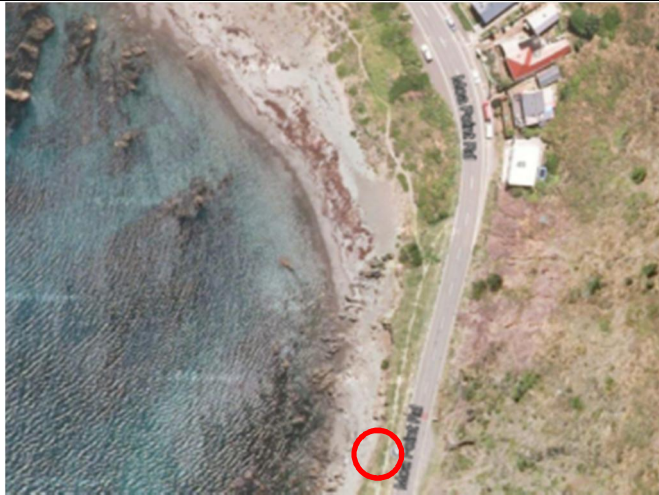
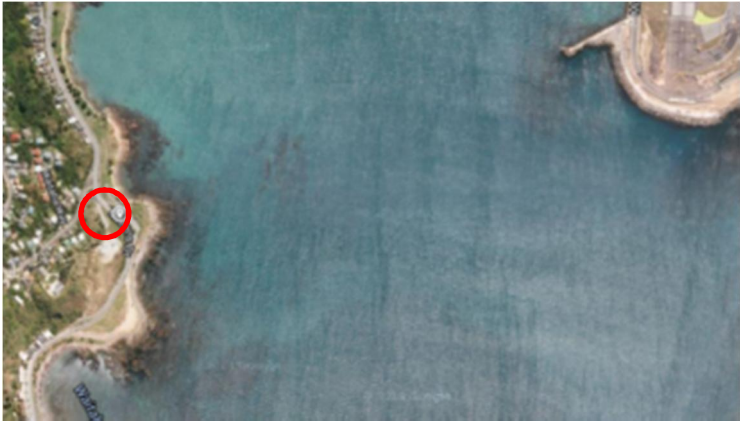
Support boat – 60 - 80 dB L_{Aeq} at 20 m – manoeuvring and at full throttle


Appendix B


Survey Locations


Appendix B Survey Locations



ID number	Location	Description	Observed noise environment	Map
L1	Moa Point Road	Opposite layby on verge facing runway nearest shore line	Cars, aircraft, surf, sea gull, cicada line	
M1	Moa Point Road	Outside 36 and 36a, on pavement in line with long term monitor	Surf, cars, dog barking, aircraft	

ID number	Location	Description	Observed noise environment	Map
M2	Moa Point Road	Opposite layby on verge facing runway nearest shore line	Cars, aircraft, surf, sea gull, cicada line	
M3	Queens Drive	Dorrie Leslie Park, water front 10 m from road opposite apartments	Cars, trucks, aircraft and some FH quarry working	

ID number	Location	Description	Observed noise environment	Map
M4	Coutts Street	Side of #244 on pavement by side of house	Aircraft, HEMS, ground running aircraft, demolition works on retail park	

ID number	Location	Description	Observed noise environment	Map
M5	Gaudin Street	Off Bridge Street near Airways Power Centre by Access gate C, side of house 23	Aircraft, ground ops, cars	

ID number	Location	Description	Observed noise environment	Map
M6	Bridge Street	Opposite #10 on open area 2 m from pavement	Aircraft, road traffic, ground ops	

ID number	Location	Description	Observed noise environment	Map
M7	Ahuiiri Street	Near #73 by NMT compound	Cars, buses, ground ops from airport clearly audible, aircraft	
M8	Bunker Way	Links View Estate	Aircraft ground ops, cars	

L1 Long term – 36a Moa Point Road**M1 – Outside 26 Moa Point Road****M2 – opposite parking bay – south of Moa Point****M3 – Dorrie Leslie Park****M4 – Coutts Street****M5 – Gaudin Street**

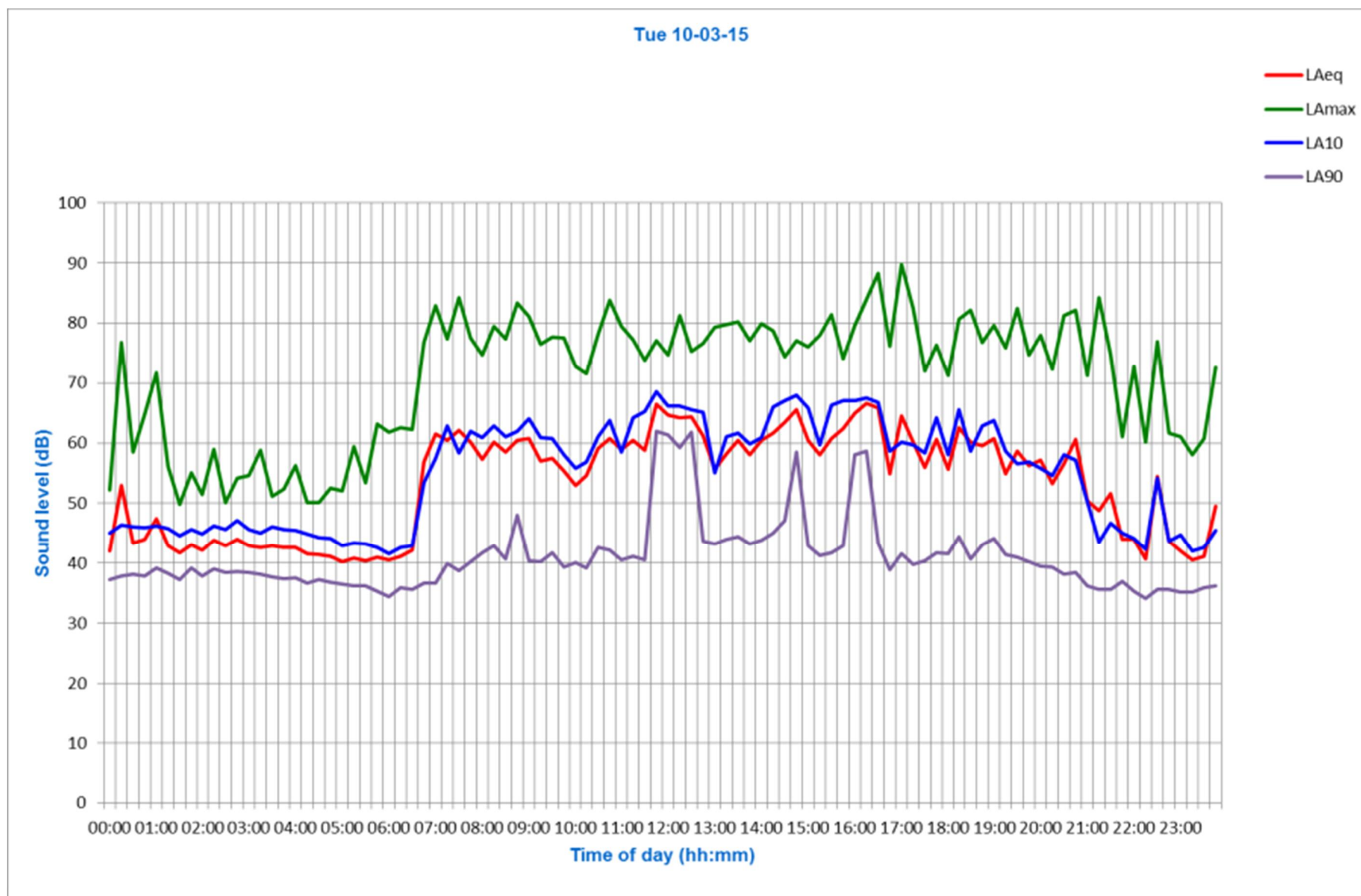
M6 – Bridge Street**M7 – Ahuiri Street****M8 – Bunker Way**

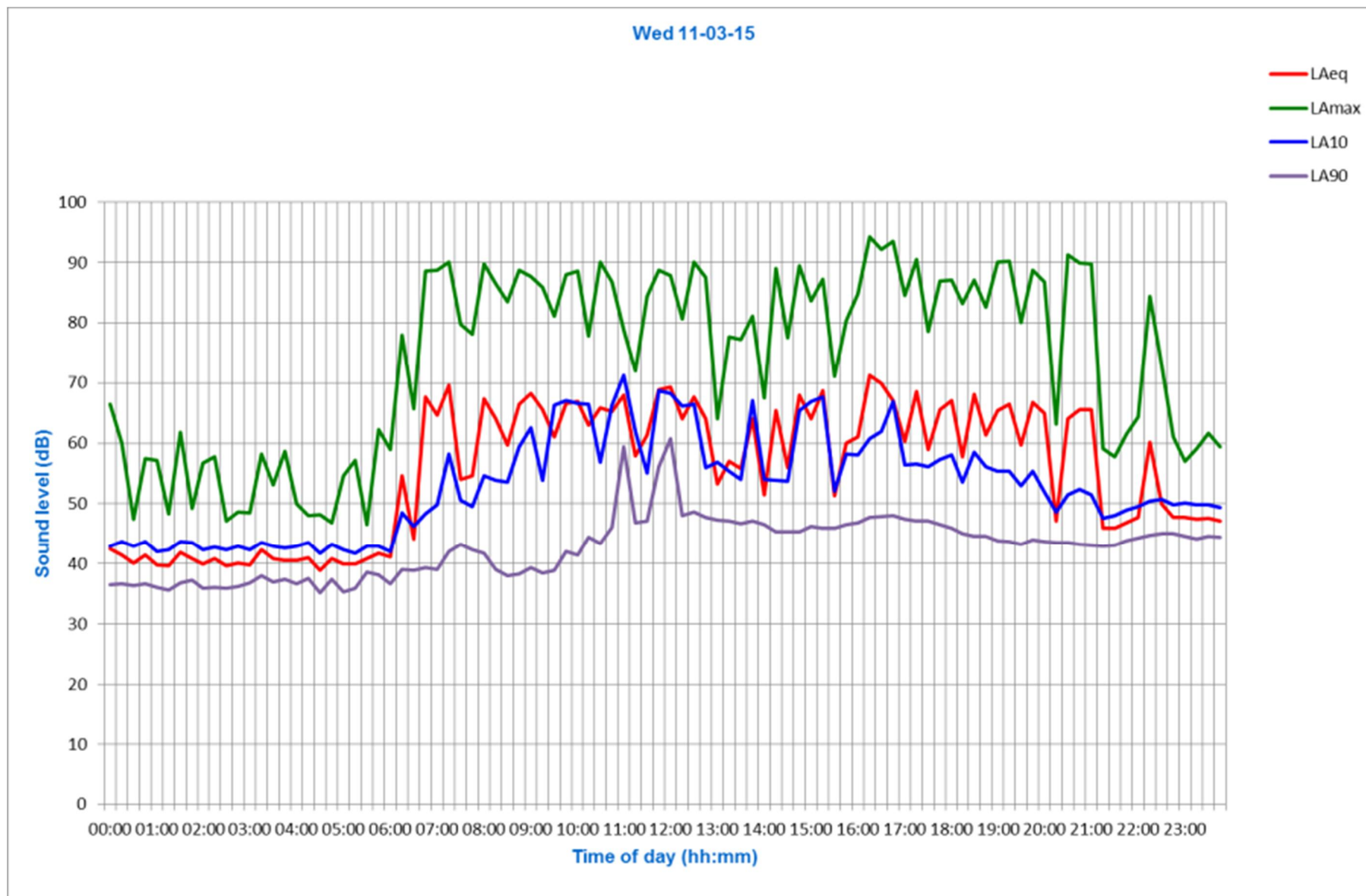
Appendix C

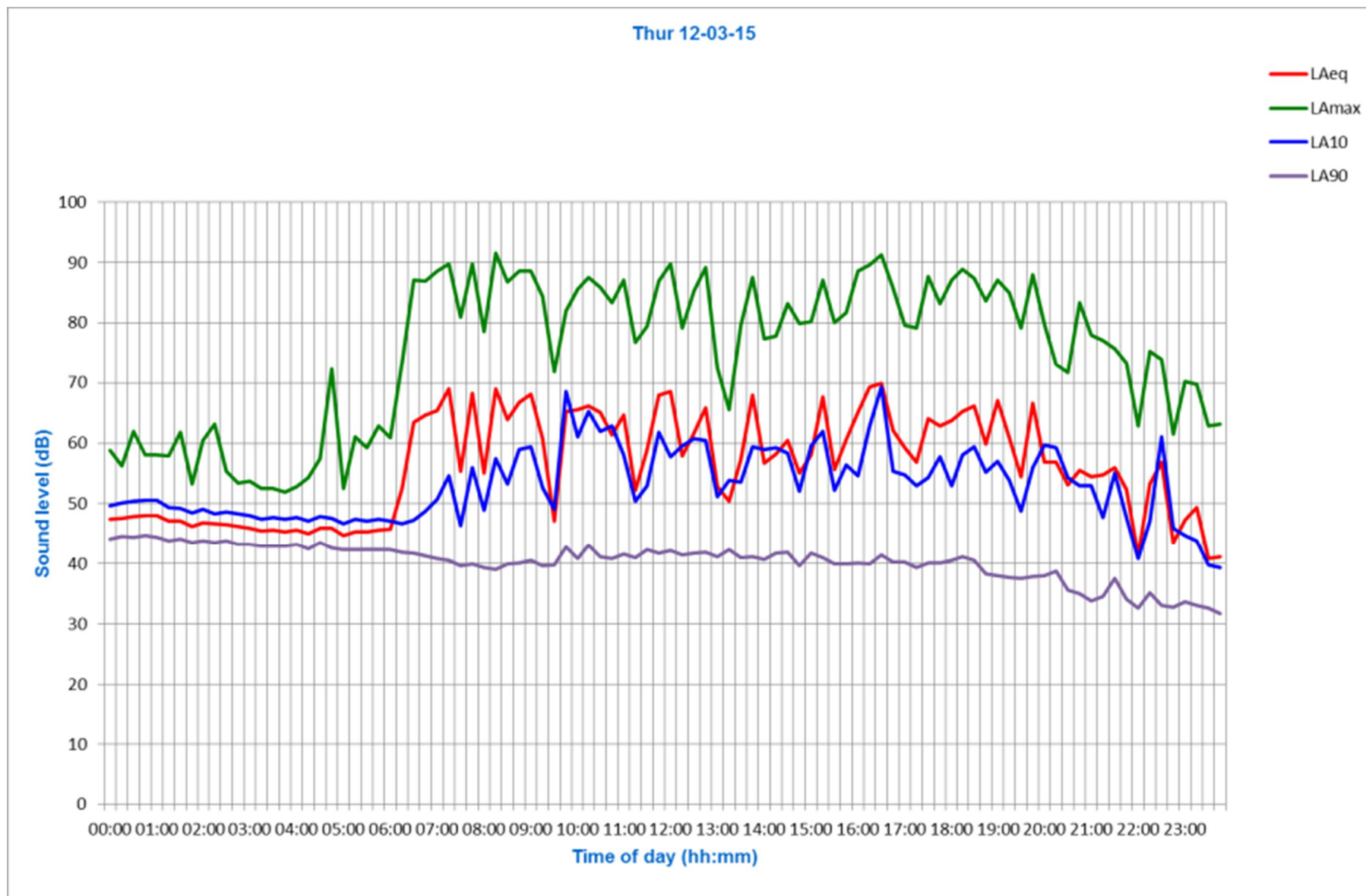
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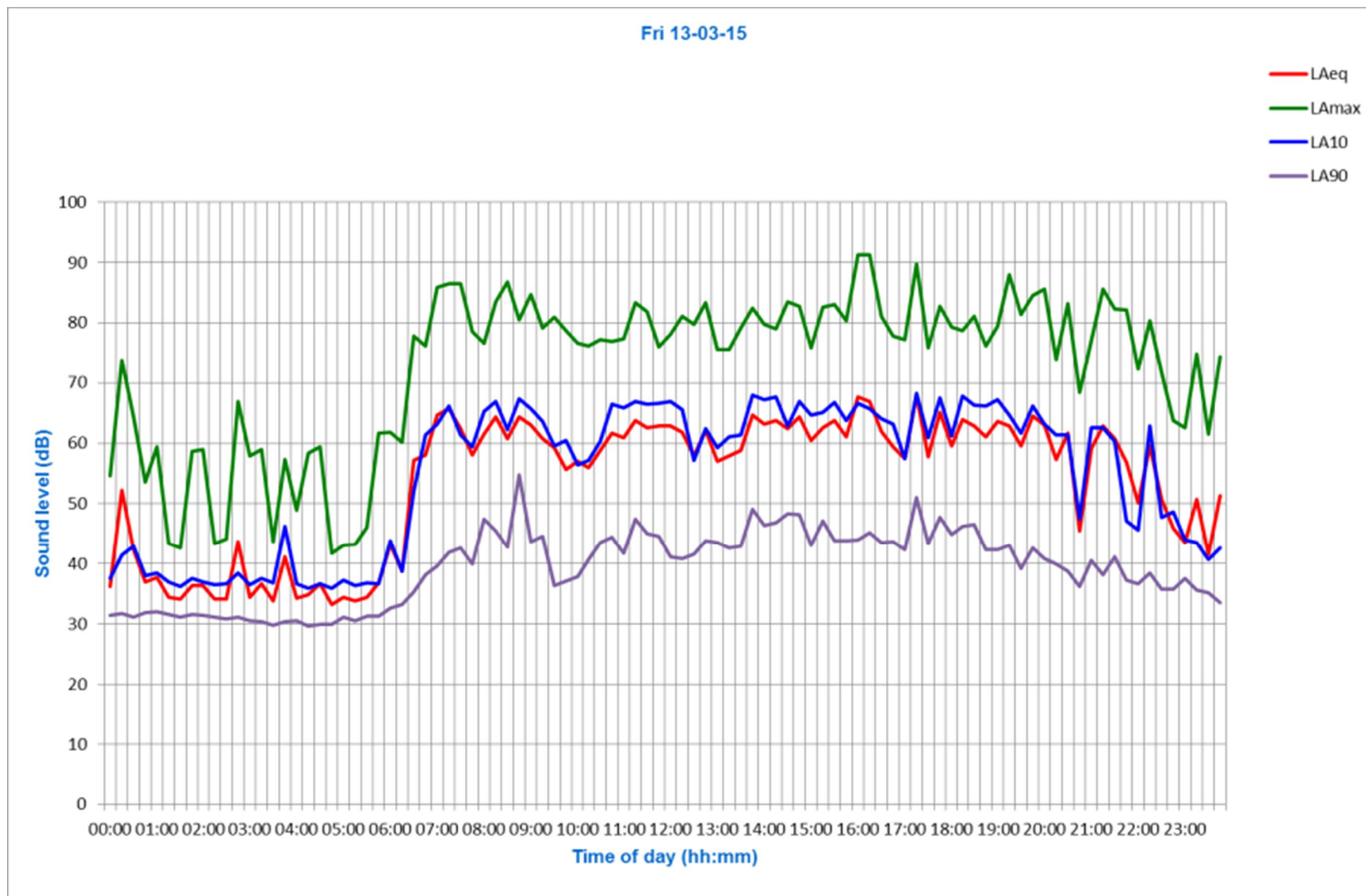
Appendix C Baseline Noise and Meteorological Data

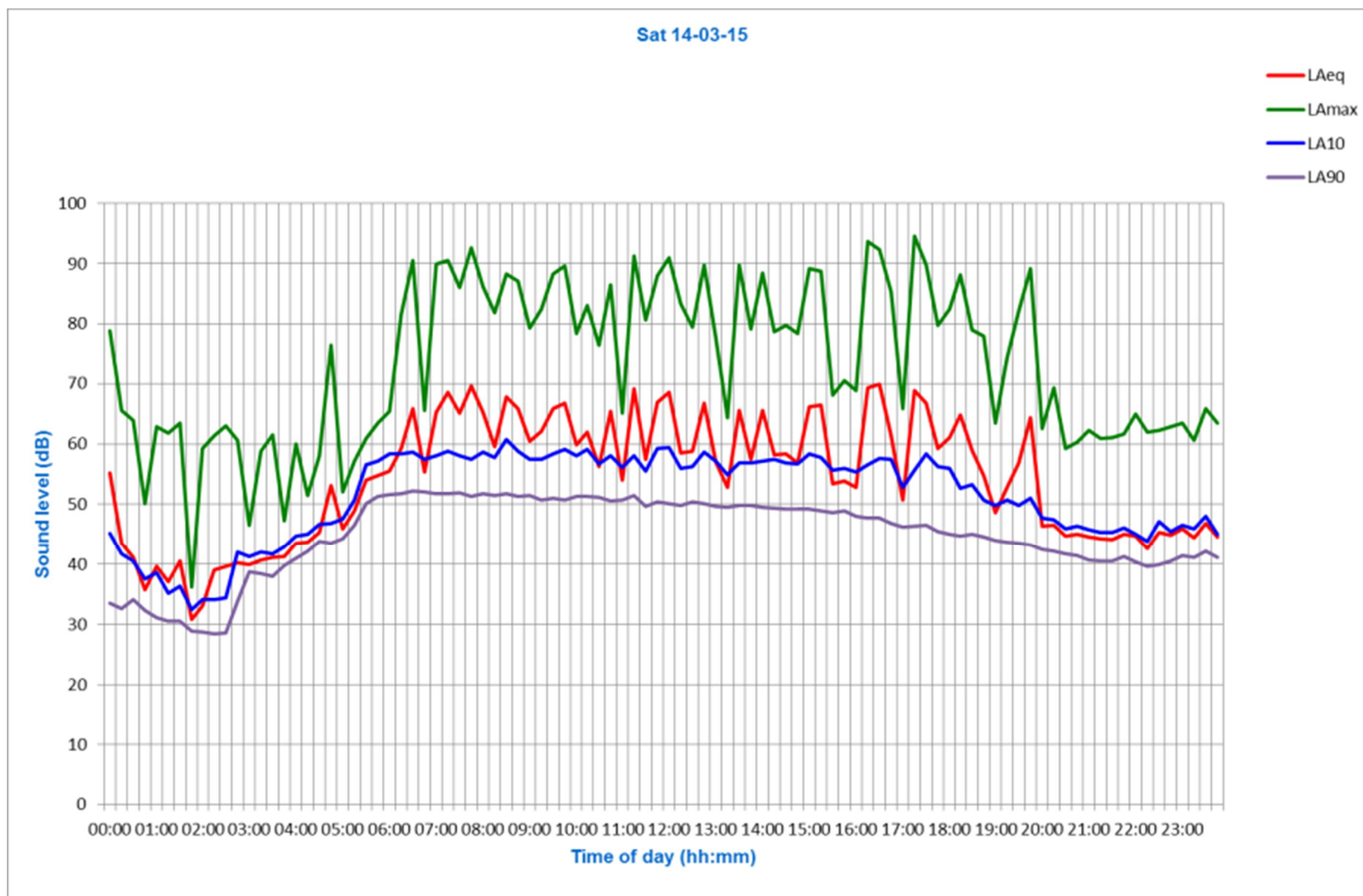
Long term noise data

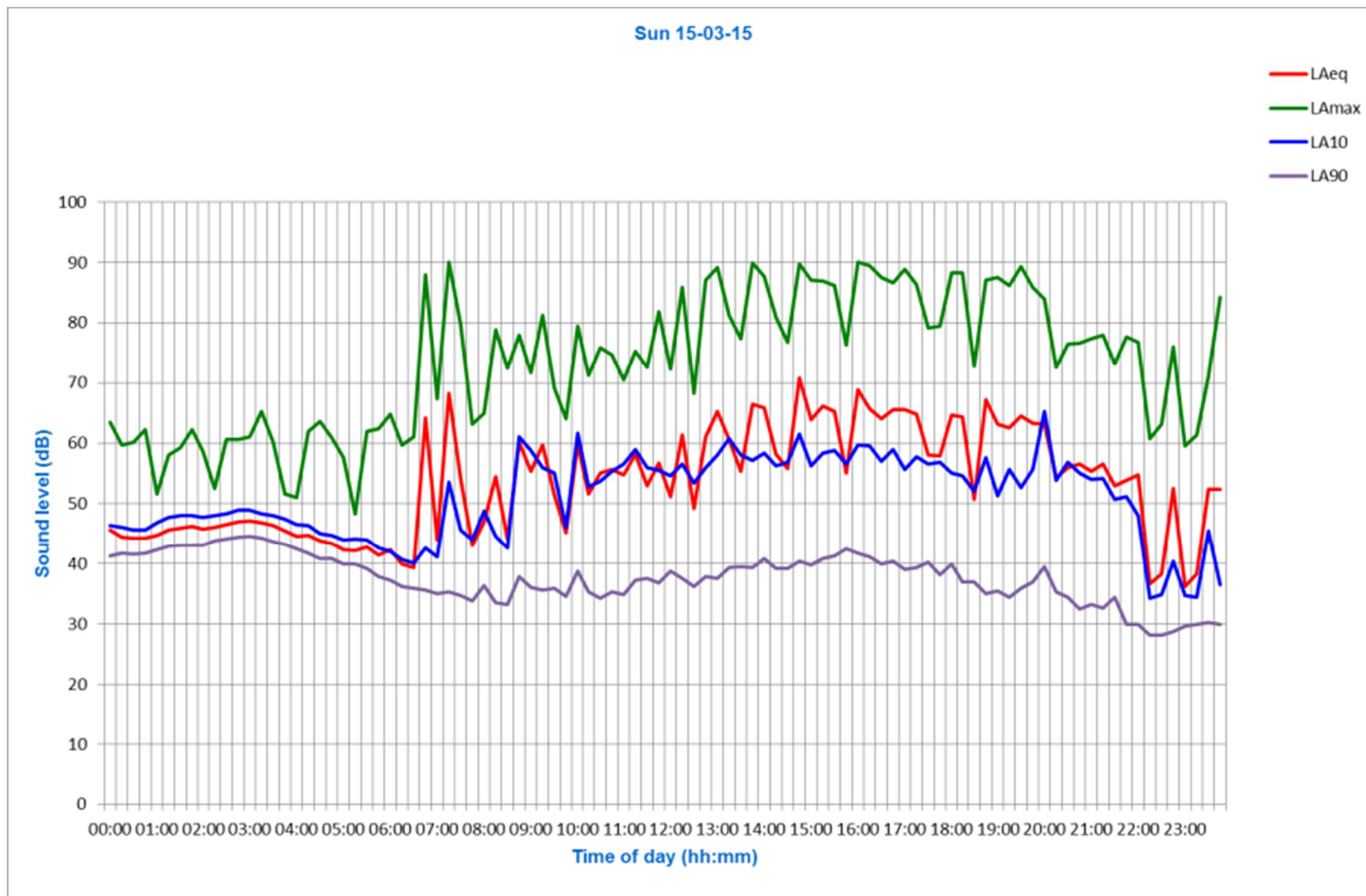


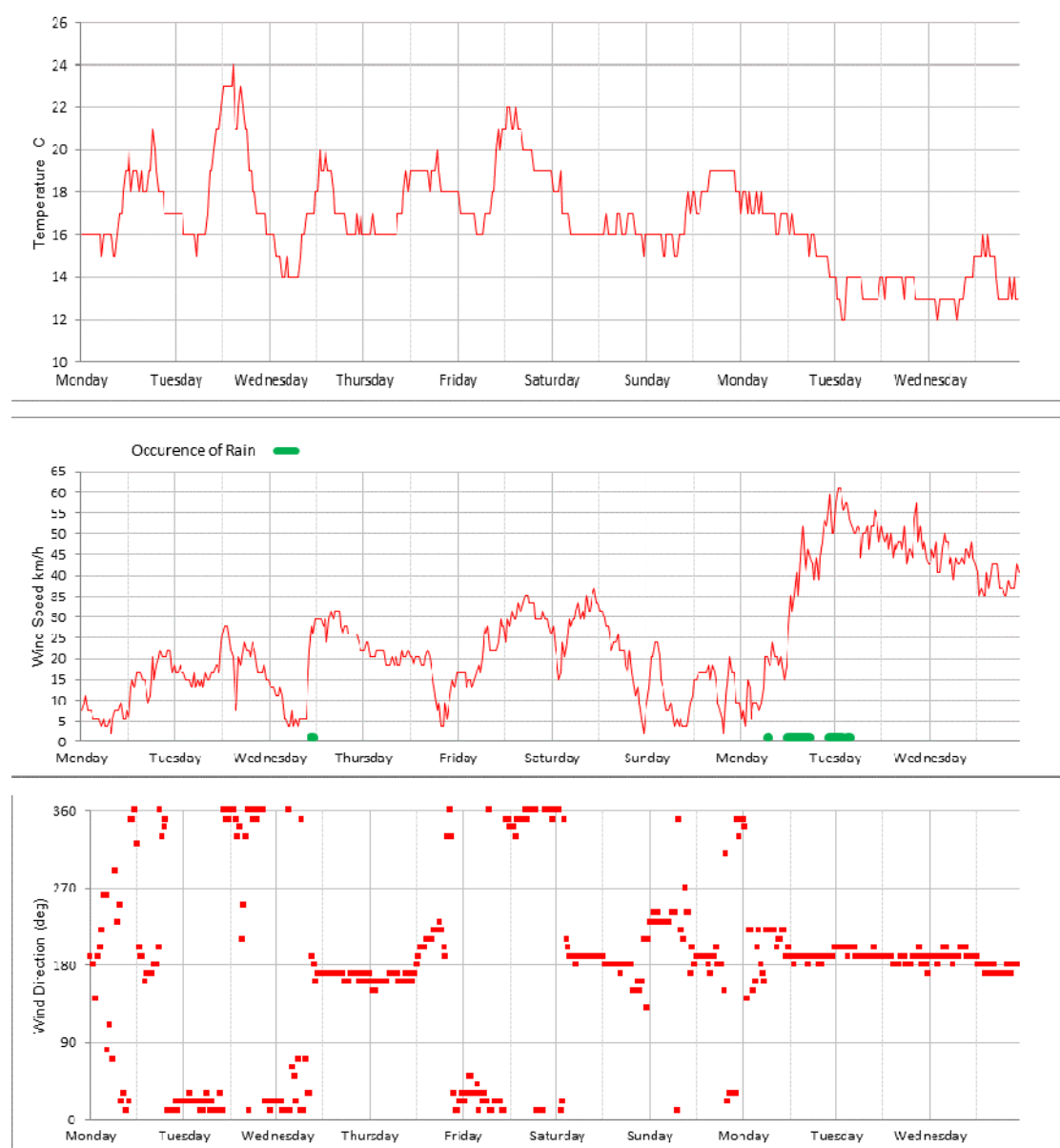


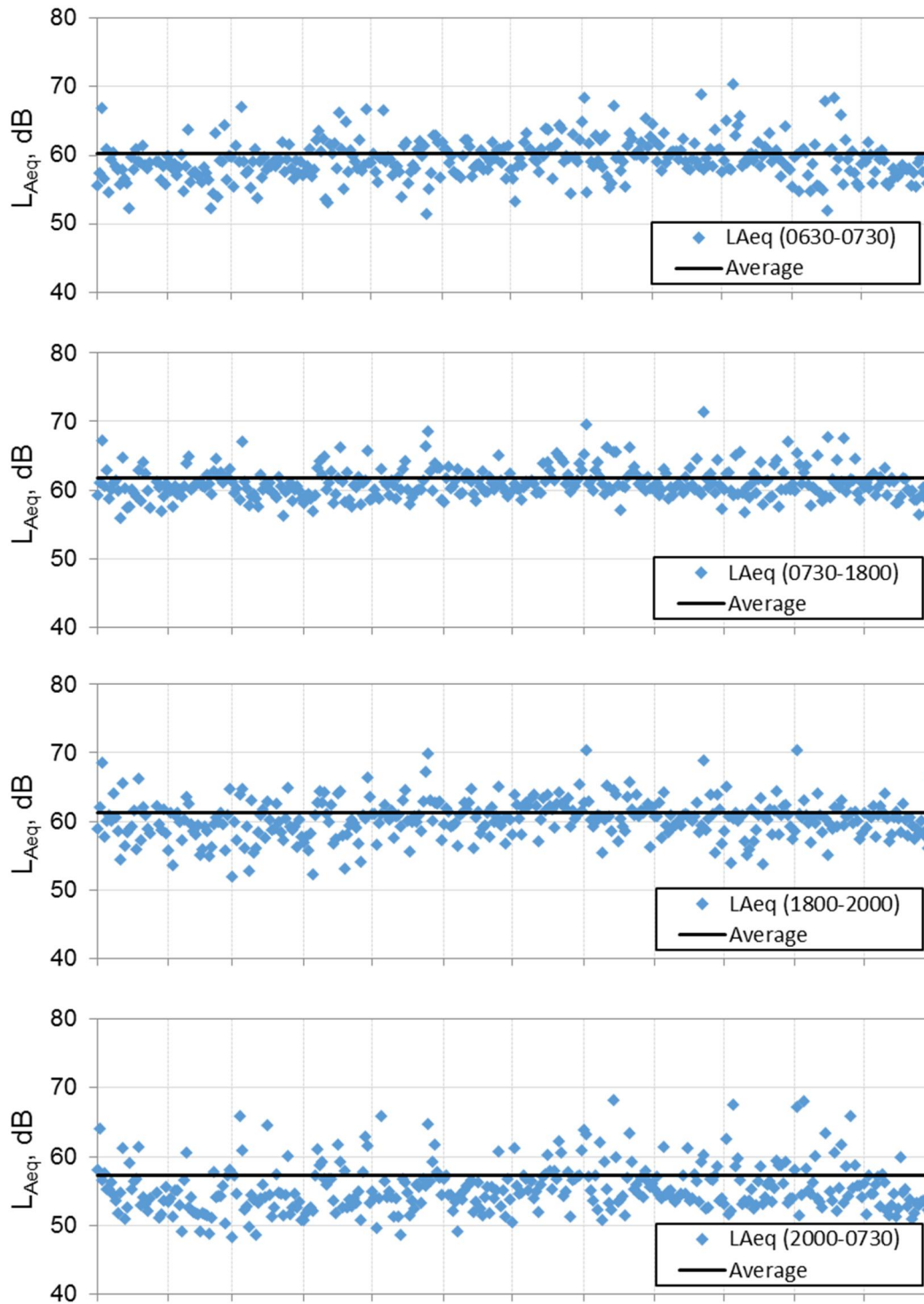


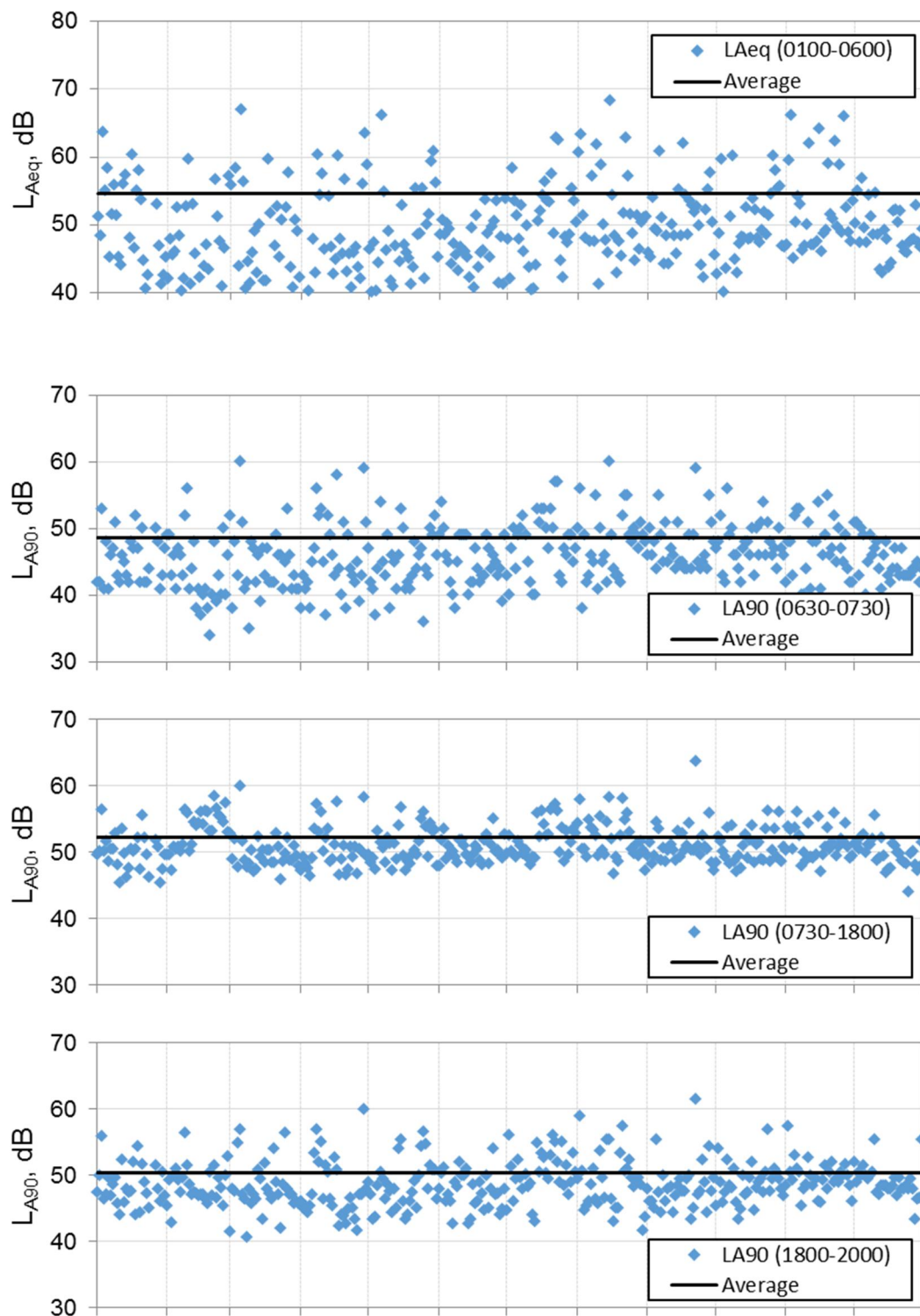


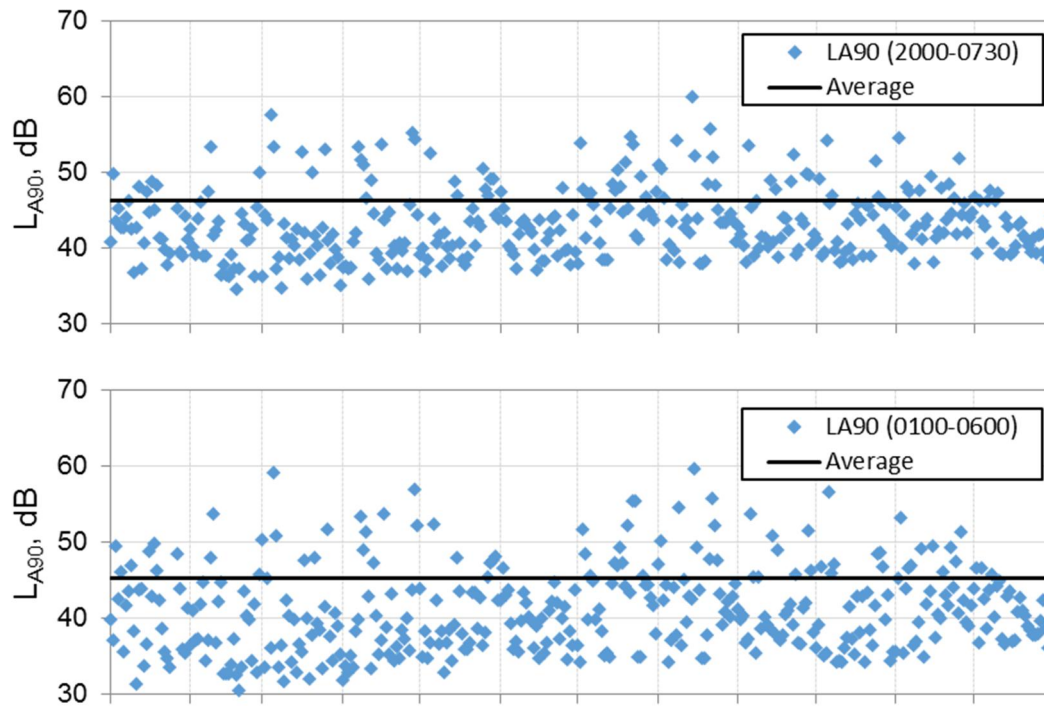




Long term meteorological data

Wellington Airport – Noise monitoring terminal data (whole of 2014)*73 Ahuriri Street in Strathmore Park*





Appendix D

Noise Calculation Data

Appendix D Noise Calculation Data

Establishment - Site compound

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Truck (delivering materials)	Idle	2	70	AECOM data	33
Mobile crane	Operating	1	70	BS 5228-1 C.4.44	50
Dozer	20 t	2	81	AECOM data	80
Vibrator roller	12 t	1	77	AECOM data	80
Roller	22 t	2	67	AECOM data	80
Support vessel	Manoeuvring	1	70	AECOM data	33
Barge Crane	Crane operating	1	79	BS 5228-1 C.4.30	50

Stage A

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Barge	Barge idle	6	60	AECOM data	50
Barge mounted stone column rig	Rig operating + vibro compaction	1	82	AECOM data	75
Support vessel	Manoeuvring	1	70	AECOM data	33

Stage B

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Barge	Barge idle	6	60	AECOM data	100
Barge Crane	Crane operating	1	77	BS 5228-1 C.4.30	50
Backhoe dredge	Barge mounted	1	68	BS 5228-1 C.2.8	50
Barge travelling	Manoeuvring	6	75	AECOM data	33

Stage C-D

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Mobile crane	Idling - barge mounted	1	60	BS 5228-1 C.4.43	50
Mobile crane	Operating - barge mounted	1	70	BS 5228-1 C.4.44	50
Truck (delivering materials)	Idle	2	70	AECOM data	25

Stage E

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Mobile crane	Idling	1	60	BS 5228-1 C.4.43	50
Mobile crane	Operating	1	70	BS 5228-1 C.4.44	50
Barge	Barge idle	6	60	AECOM data	100
Truck (delivering materials)	Idle	2	70	AECOM data	25

Stage F-G

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Mobile crane	Idling	1	60	BS 5228-1 C.4.43	50
Mobile crane	Operating	1	70	BS 5228-1 C.4.44	50
Truck (delivering materials)	Idle	2	70	AECOM data	25

Stage H

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Dredge - long reach	21 m arm	1	78	BS 5228-1 C.7.1	100
Grab hopper on barge	2136 t	1	82	BS 5228-1 C.7.2	50
Truck (delivering materials)	Idle	2	70	AECOM data	25
Dozer	20 t	1	75	BS 5228-1 C.2.1	75

Stage I

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Mobile crane	Idling	1	60	BS 5228-1 C.4.43	50
Mobile crane	Operating	1	70	BS 5228-1 C.4.44	50
Excavator	22 t tracked	2	71	BS 5228-1 C.2.21	50
Dozer	20 t	1	75	BS 5228-1 C.2.1	75

Stage J

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Excavator	22 t tracked	2	71	BS 5228-1 C.2.21	50
Water pump	Dewatering	2	79	BS 5228-1 C.4.89	100
Truck (delivering materials)	Idle	4	70	AECOM data	25

Stage K

Construction equipment	Description	Qty.	L _{Aeq} (dB at 10m)	Reference	Expected duty (%)
Dozer	20 t	2	75	BS 5228-1 C.2.1	75
Vibrator roller	12 t	2	77	BS 5228-1 C.5.21	75
Asphalt Paver (+tipper)	18 t	2	77	BS 5228-1 C.5.31	75
Roller	22 t	2	80	BS 5228-1 C.5.19	75

Appendix E

Road-traffic Noise Assessment

Appendix E Road-traffic Noise Assessment

Quarry vehicle source measurements

In support the noise management for the WAIL project a survey was performed of noise from quarrying vehicles on public roads. A survey site was selected on Mcleans Island Road in Christchurch where significant quarry truck movements occur.

A Brüel and Kjær 2250L was used for attended measurements of the pass-by sound pressure level. A SVAN 948 was used to perform .wav file recording for the duration of the measurement. The measurement equipment was set up approximately 12 m from the road edge. The setup is shown in Figure 7.

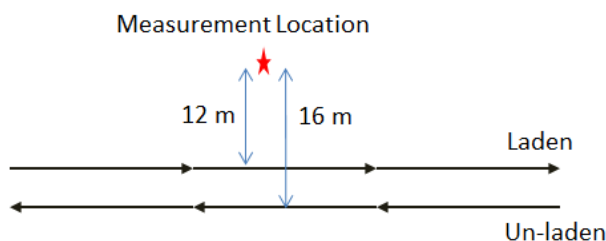


Figure 7 Layout of measurement location

As a vehicle of interest approached a measurement was started, this was then stopped once the vehicle passed the measurement site. These measurements took approximately 15 seconds each. There was significant wind noise, noise from other traffic, and noise. The noise from the trucks was clearly audible above the other extraneous noise sources. Eleven laden and 6 un-laden vehicles were evaluated.

Observation notes were:

- Un-laden vehicles made more impulsive noise, e.g. bangs and rattles.
- Highest noise levels were generated by vehicles braking. This was the case for all un-laden vehicles.
- When laden vehicles accelerated heavily the noise levels were higher than if they were able to accelerate over a longer period.
- There was significant background noise contamination.
- Trucks that passed through without stopping or slowing at the intersection were noticeably quieter than those that had to accelerate or brake at the intersection.

The overall noise levels measured from the quarry trucks are summarised in Table 15.

Table 15 Quarry vehicle pass-by noise

Measurement Details	Noise Level
LA _{eq} Laden	65.2 dB
LA _{eq} Un-laden	62.2 dB
LAF _{max} Laden	72.4 dB
LAF _{max} Un-laden	68.0 dB

The frequency spectrum of the truck noise is shown in Figure 8.

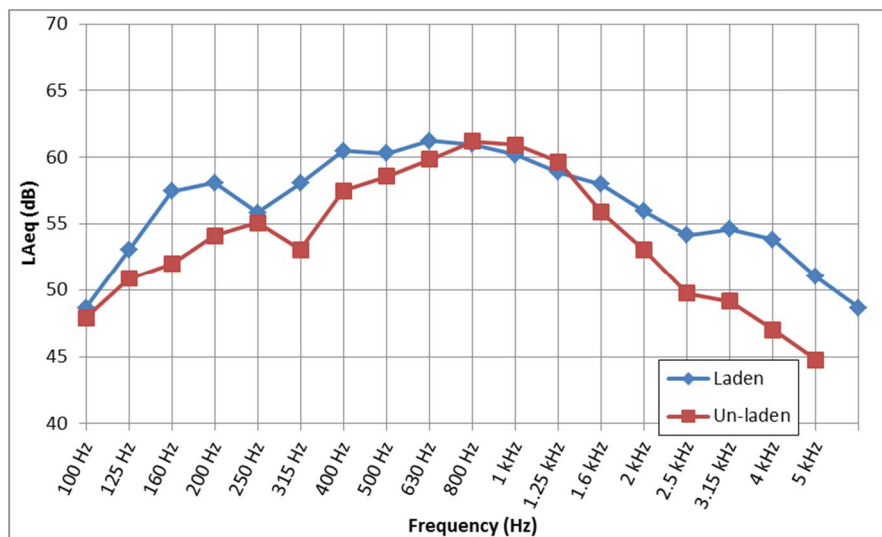


Figure 8 Frequency spectrum of measured haulage vehicles

CRTN assessment

The following road traffic noise assessment details the number of dwelling within the 10m distance bands from 0 to 50m along each of the eight road segments.

The traffic flows and road-traffic noise levels generated by the construction vehicle movements in conjunction with the existing traffic conditions are detailed on the diurnal profile graphs for each road segment. The project's construction traffic flows are based on the data in Table 13. These flows are the maximum flows before a greater than 3dB increase in noise level occurs between the existing and 'with' project traffic flows.

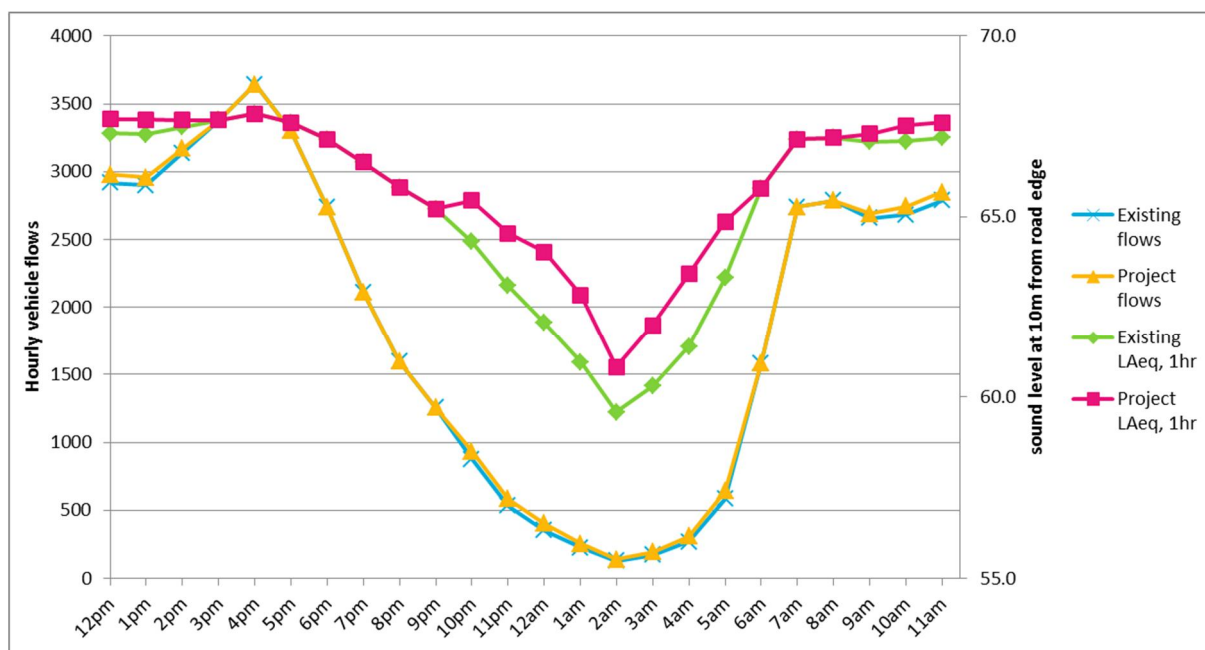
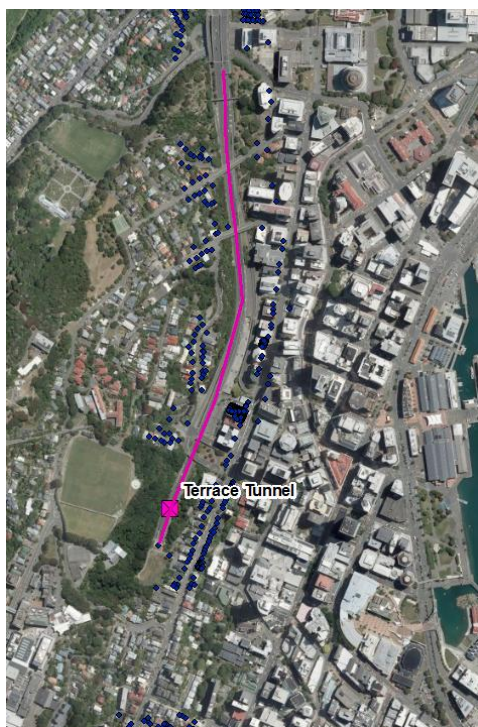
Hawkestone Interchange

Distance Range	Number of Potential Receivers
0 to 10m	1
10 to 20m	2
20 to 30m	5
30 to 40m	15
40 to 50m	55



Terrace Tunnel

Distance Range	Number of Potential Receivers
0 to 10m	1
10 to 20m	1
20 to 30m	0
30 to 40m	24
40 to 50m	38



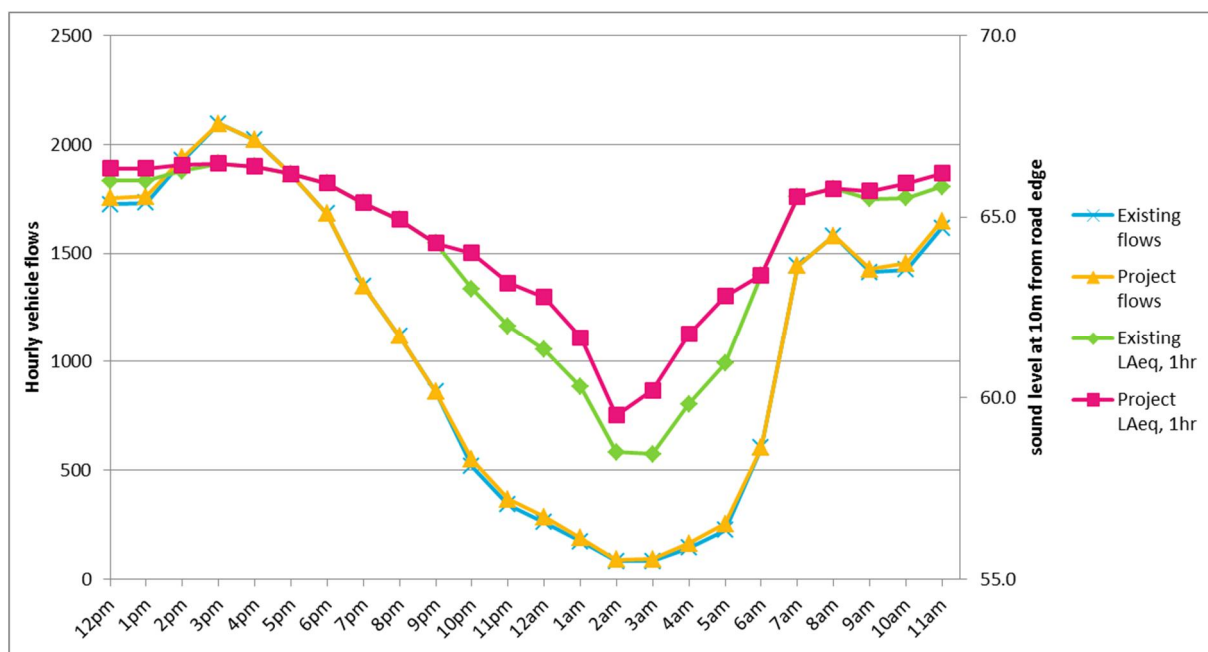
Vivian Street

Distance Range	Number of Potential Receivers
0 to 10m	8
10 to 20m	169
20 to 30m	44
30 to 40m	59
40 to 50m	55



Arthur Street

Distance Range	Number of Potential Receivers
0 to 10m	8
10 to 20m	89
20 to 30m	94
30 to 40m	82
40 to 50m	81



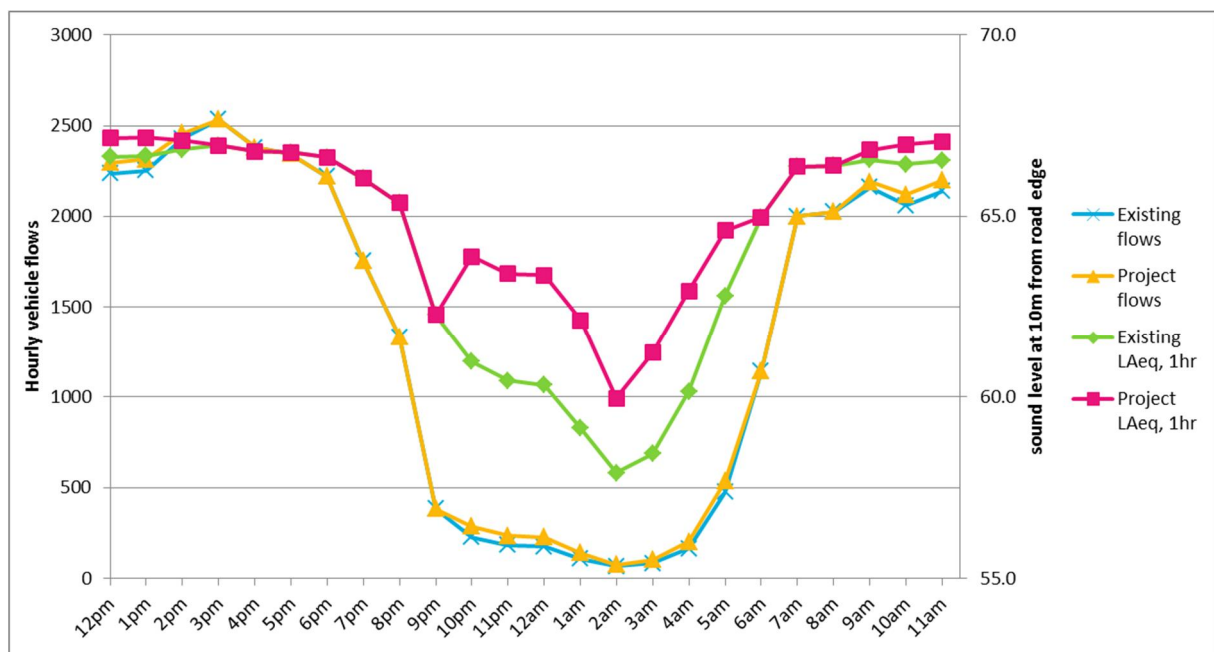
Paterson Street

Distance Range	Number of Potential Receivers
0 to 10m	0
10 to 20m	3
20 to 30m	19
30 to 40m	10
40 to 50m	6



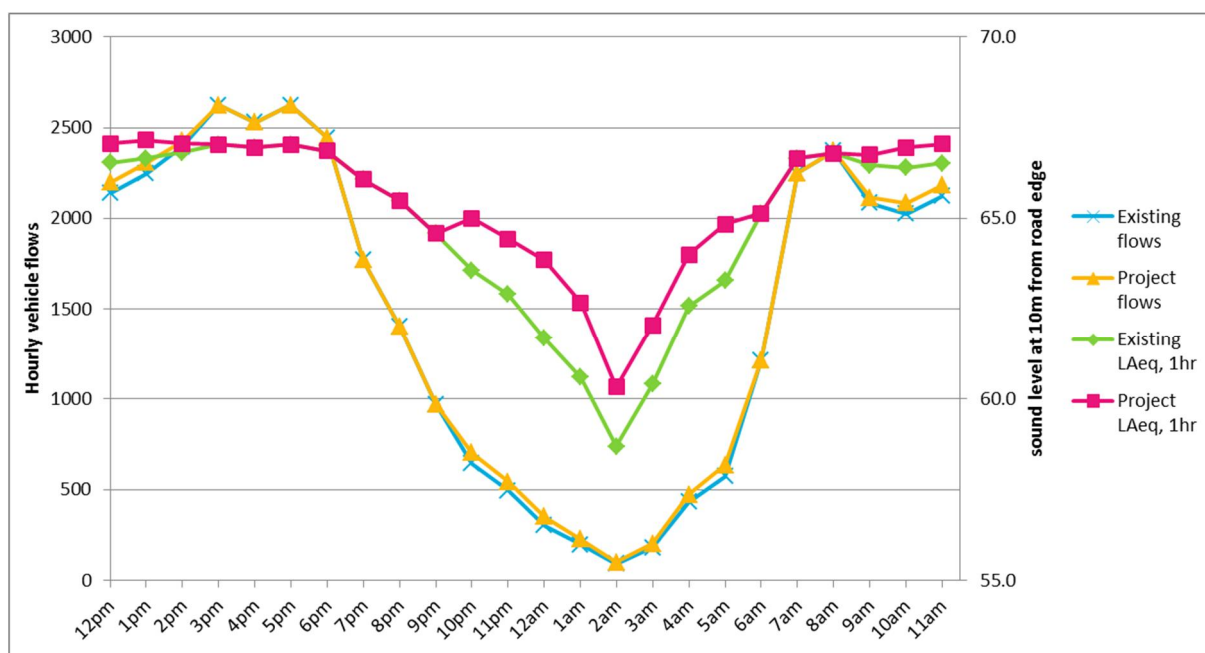
Ruahine Street

Distance Range	Number of Potential Receivers
0 to 10m	0
10 to 20m	15
20 to 30m	10
30 to 40m	9
40 to 50m	6



Cobham Drive

Distance Range	Number of Potential Receivers
0 to 10m	0
10 to 20m	34
20 to 30m	9
30 to 40m	9
40 to 50m	9



Calabar Road

Distance Range	Number of Potential Receivers
0 to 10m	1
10 to 20m	10
20 to 30m	8
30 to 40m	15
40 to 50m	20



Appendix F

Construction Noise Vibration Management Plan

Appendix F Construction Noise Vibration Management Plan

WIAL Runway Extension

DRAFT Construction Noise and Vibration Management Plan

DRAFT

WIAL Runway Extension

DRAFT Construction Noise and Vibration Management Plan

Client: Wellington International Airport Limited

Co No.: 396240

Prepared by

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22-Apr-2016

Job No.: 60435923

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Quality Information

Document	WIAL Runway Extension
Ref	60435923
Date	22-Apr-2016
Prepared by	Darran Humpheson
Reviewed by	Michael Smith

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Construction Noise Induction	A

Abbreviations and Glossary

Abbreviation	Description
CNVMP	Construction Noise and Vibration Management Plan
NZS	New Zealand Standard
TBC	To be confirmed
WIAL	Wellington International Airport Limited

Term	Definition
dB	A unit of measurement on a logarithmic scale, often used to describe the magnitude of sound pressure with respect to a reference value (20 μ Pa)
$L_{Aeq(t)}$	The A-weighted time-average sound level over a period of time (t), measured in units of decibels (dB)
L_{AFmax}	The maximum A-weighted noise level with a 1/8 second or 'Fast' time constant (indicated by a 'F'), measured in units of decibels (dB)

1.0 Introduction

This construction noise and vibration management plan details noise and vibration criteria, mitigation measures, monitoring requirements, and communication and complaint procedures, for:

Project: WIAL Runway Extension

Construction location: Wellington Airport

Construction start date: TBC

Construction finish date: TBC

Contractor: TBC

An assessment of the construction noise and vibration^[1] has been undertaken and this plan has been prepared based on this assessment.

1.1 Scope

This plan covers the following for this project:

- Airborne noise from the construction works and haul routes

With the exception of the vibration from vehicle movements on the haul roads, the vibration generated from the works will not be significant and therefore whilst this plan does mention vibration, there is no detailed assessment or proposed control measures.

Underwater noise from the works and the associated impacts on marine life are covered in a separate management plan^[2].

1.2 Construction details

Table 1 Contact details

Role	Name	Organisation	Phone	Email
Client, Environment Manager	TBC	WIAL	TBC	TBC
Project Engineer	TBC	TBC	TBC	TBC
Contractor, Project Manager	TBC	TBC	TBC	TBC
Contractor's acoustics advisor	TBC	TBC	TBC	TBC
Council – Noise/ Environmental Health	TBC	TBC	TBC	TBC
Public complaint contact number	TBC	TBC	TBC	TBC

[Contractor, Project Manager] will be responsible for ensuring that this construction noise and vibration management plan is correctly implemented. They will review all documentation relating to construction noise and vibration before it is issued.

All site personnel will be required to read and sign the construction noise and vibration induction form appended to this plan (Appendix a). If required, specific training will be provided for site personnel.

¹ Construction noise – Wellington Airport Runway Extension. AECOM Report 42199020/R01/07, 22 April 2016.

² TBC

2.0 Project Overview

Wellington International Airport Limited (WIAL) are extending the southerly runway into Lyall Bay by approximately 355 m into Lyall Bay to enable larger and heavier aircraft to be handled.

The runway extension project will involve reclaiming land from the sea and constructing a paved runway, taxiway and associated infrastructure. Delivery of the new extended runway will take approximately 36 to 48 months.

2.1 Construction methodology

A description of the construction methodology is presented in **Table 2**.

Table 2 Construction methodology

Stage	Duration (months)	Activity
0	2	Establishment of site compound.
A	14	Installation of stone columns beneath the rock dyke, if required. Commence installation of stone columns from the start of the eastern/western seawalls (existing land) and 1/3 along the seawall working outwards into deeper water. Occasionally, there may be periods of time when night work for the installation of stone columns under the western and eastern dykes is required to keep the project to programme.
B	14	Once stone columns are sufficiently advanced, commence installation of stone blanket over stone columns and adjacent filter layer on seabed and secondary armour layer over seabed filter layer. Trim all rock to final profile
C	14	Once stone blanket, seabed filter layer and secondary armour over seabed filter are sufficiently advanced, commence installation of core rock to the rock dyke. Remove existing Akmon armour units in the immediate vicinity where land-based operations have commenced.
D	14	Progressively place filter layer to outside of core batter and trim to profile. Trim top of core material to obtain filter profile to complete placement of filter material.
E	15	Place primary armour to toe; secondary armour over batter filter layer; followed by outer primary armour to batter. Progressively recover existing Akmon armour units to place on outside of new eastern rock dyke.
F	13	Complete core and filter to top surface and then place secondary armour and primary armour top (horizontal) layers. Leave out accropods immediately adjacent to precast concrete wall location.
G	1	Fabricate geotextile into large panels and roll onto mandrel. Fix geotextile to top of rock dyke and roll down the batter.
H	5 or 18	Construction reclamation using locally dredged material and marine-based equipment. Alternatively, up to 18 months using land-based (and possibly marine based) equipment and land-based fill material: For the marine-based method, establish pumping connections and locations for off-load of the dredged material from marine-based equipment, as well as flow discharge points from reclamation. Commence reclamation from end of existing runway working outwards toward the southern rock dyke, relocating flow discharge points as needed. Once entire reclamation is filled, place final

Stage	Duration (months)	Activity
		dredged layer to finished surface level. For the land-based method place fill across the east-west width of the reclamation and progress in a southerly direction, starting at the southern end of the existing land.
I	3	Once reclamation is complete, place precast concrete wave wall units (3-metre-long precast units ~30 tonnes each) using crawler crane. Place final accropodes in position adjacent to the precast structure. Place precast drain and graded gravel surface to top surface of precast units.
J	1 -10	Commence installation of wick drains to reclamation (1 month). Once 50 percent of an area is completed, commence construction of surcharge if required (up to 10 months). Alternatively, perform ground improvement (such as vibrocompaction) of reclamation fill materials.
K	10	Remove surcharge. Construct airfield drainage, pavements, and install navigation lighting, etc. Construct amenity improvements to Moa Point Road and Moa Point Beach.

2.2 Transportation of materials

The exact means of importing material (by road / water) for the reclamation has not yet been determined but for the purposes of this plan it has been assumed that there are a maximum of 310 trucks per day on the road network and an estimated six delivery by barge per day (i.e. 12 two-way movements.) There would be additional boat movements from support vessels, which are estimated to be four movements in any one day.

The daytime route (**Figure 1**) has been designed to work within the existing traffic conditions at existing intersections along the route and includes a separate inbound and outbound route. The inbound route leaves Cobham Drive (SH1) and Calabar Road before entering the airport precinct along Stewart Duff Drive before entering the construction site. The outbound route leaves the work site along Moa Point Road before continuing along Lyall Parade, before turning on Onepu Road and Evans bay Road before re-joining SH1. This daytime route has the ability to accommodate up to 30 trucks per hour between the hours of 0930h to 1430h, resulting in a maximum of 150 trucks per day.

The night time route (**Figure 2**) uses the same haul route from Cobham Drive (SH1) before entering the airport precinct via Calabar Road, i.e. an identical route to the daytime inbound route. Night time movements are noise constrained and the assessment has concluded that a maximum of 160 trucks would be acceptable on a staggered basis between 2200h and 0600h.

2.3 Hours of operation

Because of constraints on the work activities (operating airport, weather/sea conditions, bulk material movements, specialist plant), construction work could potentially occur at any time of the day or night.

The operation of the airport will be the main constraint and works will be required to take place at night when scheduled domestic aircraft movements are prohibited between 0000h and 0600h and between 0100h to 0600h for scheduled international aircraft arrivals. During this period, ambient noise levels from the airport and other sources of noise will be at their lowest and any night-time works may have the potential to increase the likelihood of disturbance to local residents.

2.4 Location plan

Figure 3 illustrates the location of the airport and the haulage route with the site location.

Figure 1 Day time haulage route



Figure 2 Night time haulage route



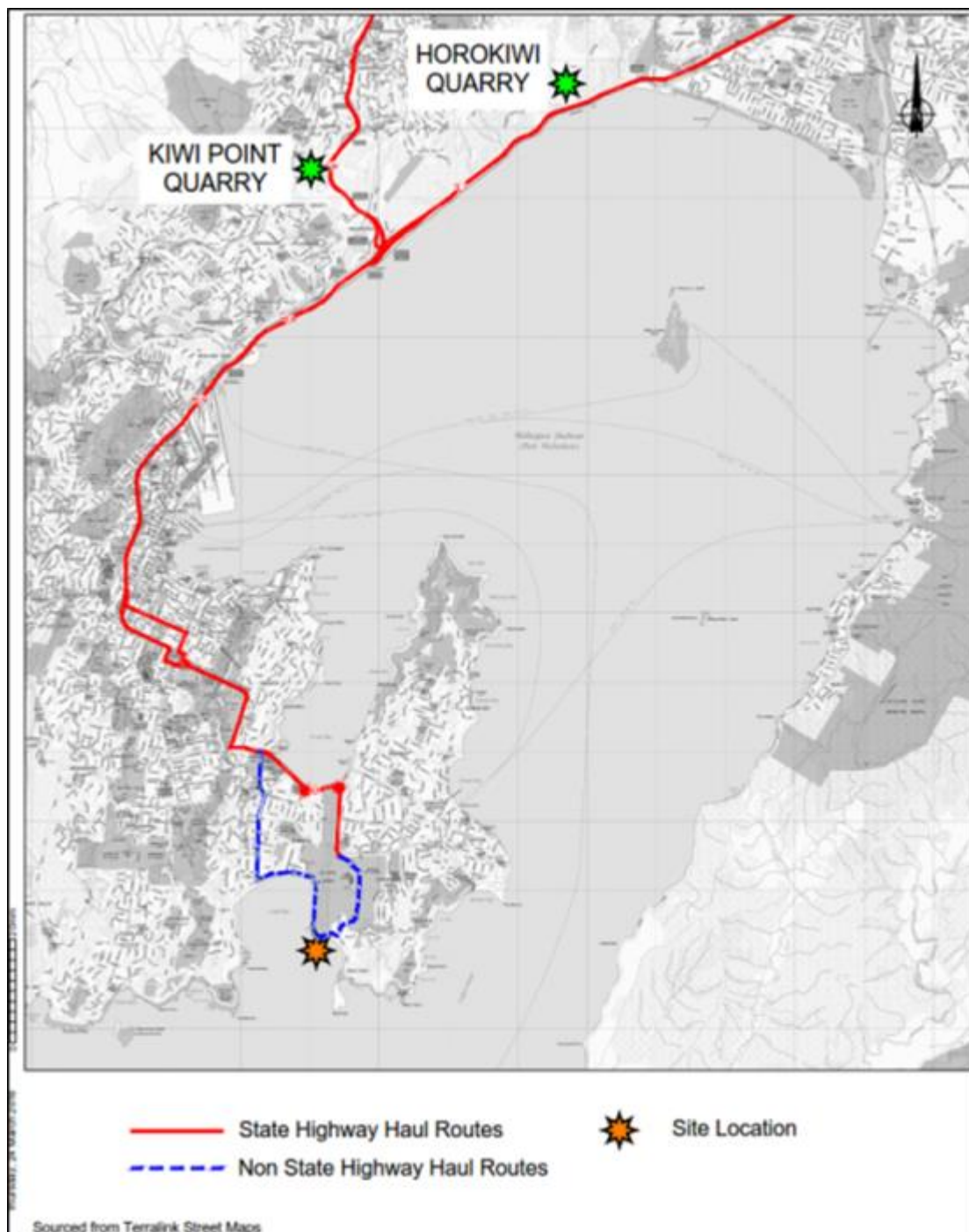


Figure 3 Route from the proposed quarry locations to the airport

3.0 Criteria

The noise limits from NZS 6803³ have been adopted for these works and the guideline limits for works with a duration of over 20 weeks are reproduced in **Table 3**.

Table 3 NZS 6803 guideline construction noise limits

Receiver type	Day	Time period	Guideline noise limit	
			L _{Aeq} (15min)	L _{AFmax}
Residential	Weekdays	0630-0730	55 dB	75 dB
		0730-1800	70 dB	85 dB
		1800-2000	65 dB	80 dB
		2000-0630	45 dB	75 dB
	Saturdays	0630-0730	45 dB	75 dB
		0730-1800	70 dB	85 dB
		1800-2000	45 dB	75 dB
		2000-0630	45 dB	75 dB
	Sundays and public holidays	0630-0730	45 dB	75 dB
		0730-1800	55 dB	85 dB
		1800-2000	45 dB	75 dB
		2000-0630	45 dB	75 dB
Industrial and commercial	All days	0730-1800	70 dB	-
		1800-0730	75 dB	-

These noise limits will be updated once the project's resource consent conditions are known.

³ New Zealand Standard NZS 6803:1999 Acoustics – Construction Noise.

4.0 Sensitive Locations

The nearest sensitive locations are listed in **Table 4**. Receivers have been included at recreational locations affected by construction and haulage noise.

Table 4 Sensitive receivers

Type	Receiver	Distance in metres to:			
		Existing runway	Runway extension	Worksite closest proximity	Haul route
Residential	R1 - Moa Point	310	310	180	100
	R2 - Monorgan Road	900	1,400	1,360	420
	R3 - Raukawa Street	750	800	690	290
	R4 - Bunker Way	740	930	840	220
	R5 - Kekerenga Street	590	620	490	335
	R6 - Ahuriri Street	640	660	500	420
	R7 - Bridge Street	100-160	1,310	1,380	270
	R8 - Tirangi Road	200	1,200	1,370	440
	R9 - Lyall Parade	1,000	1,120	1,060	15
	R10 - Queens Drive	1,250	1,150	1,070	900
	Calabar Road (northern end)	195	2,000	1,980	35
	Calabar Road (southern end)	165	1,380	1,370	18
	Onepu Road	960	1,400	1,160	15
Commercial	R11 - Tirangi Road / Kingsford Smith Street	320	1,000	1,020	20
Recreational	Outdoor seating at Spruce Goose café	210	1,000	880	15
	Surfing activities and other users of Lyall Bay beach	220	900	840	30
	Plane spotters on Moa Point Rd	100	280	100	10
	Walkers on south coast	160	270	50	10
	Golf course (closest point)	384	485	340	30



Figure 4 Noise calculation locations

5.0 Noise Sources

In terms of noise, **Table 5** lists all the significant equipment proposed to be used on the site. The sound level for each item of equipment has been estimated from measurements made during previous projects and library data in British Standard BS 5228-1:2009. During initial site noise monitoring the validity of this data will be confirmed and adjusted where necessary for the major items of equipment. Amended data will be included within the relevant CNVMP noise schedules.

Table 5 Likely equipment

Equipment	Description	L _{Aeq} (dB at 10m)	Reference
Asphalt Paver (+tipper)	18t	77	BS 5228-1 C.5.31
Truck (delivering materials)	Idle	70	AECOM data
Mobile crane	Operating	70	BS 5228-1 C.4.44
Dozer	20t	81	AECOM data
Vibrator roller	12t	77	AECOM data
Roller	22t	67	AECOM data
Support vessel	Manoeuvring	70	AECOM data
Barge Crane	Crane operating	79	BS 5228-1 C.4.30
Barge	Barge idle	60	AECOM data
Barge mounted stone column rig	Rig operating + vibro compaction	82	AECOM data
Support vessel	Manoeuvring	70	AECOM data
Barge travelling	Manoeuvring	75	AECOM data
Mobile crane	Idling - barge mounted	60	BS 5228-1 C.4.43
Mobile crane	Operating - barge mounted	70	BS 5228-1 C.4.44
Dredge - long reach	21 m arm	78	BS 5228-1 C.7.1
Grab hopper on barge	2136 t	82	BS 5228-1 C.7.2
Truck (delivering materials)	Idle	70	AECOM data
Excavator	22t tracked	71	BS 5228-1 C.2.21
Water pump	Dewatering	79	BS 5228-1 C.4.89
Vibrator roller	12t	77	BS 5228-1 C.5.21
Roller	22t	80	BS 5228-1 C.5.19

Table 6 shows the key activities likely to generate significant noise. The list will be updated as required during the preparation of the CNVMP noise schedules.

Table 6 Key activities – noise

Stage	Equipment	Description
0	Truck (delivering materials)	Idle
	Mobile crane	Operating
	Dozer	20 t
	Vibrator roller	12 t
	Roller	22 t
	Support vessel	Manoeuvring
	Barge Crane	Crane operating
A	Barge	Barge idle
	Barge mounted stone column rig	Rig operating + vibro compaction
	Support vessel	Manoeuvring
B	Barge	Barge idle
	Barge Crane	Crane operating
	Backhoe dredge	Barge mounted
	Barge travelling	Manoeuvring
C+D	Mobile crane- barge mounted	Idling
	Mobile crane- barge mounted	Operating
	Truck (delivering materials)	Idle
E	Mobile crane	Idling
	Mobile crane	Operating
	barge	Barge idle
	Truck (delivering materials)	Idle
F+G	Mobile crane	Idling
	Mobile crane	Operating
	Truck (delivering materials)	Idle
H	Dredge - long reach	21 m arm
	Grab hopper on barge	2136 t
	Truck (delivering materials)	Idle
	Dozer	20 t
I	Mobile crane	Idling
	Mobile crane	Operating
	Excavator	22 t tracked
	Dozer	20 t
J	Excavator	22 t tracked
	Water pump	Dewatering
	Truck (delivering materials)	Idle

Stage	Equipment	Description
K	Dozer	20 t
	Vibrator roller	12 t
	Asphalt Paver (+tipper)	18 t
	Roller	22 t

6.0 Schedules

For the following high noise risk activities separate noise schedules will be prepared.

- Stage A - Installation of any stone columns beneath the rock dyke.
- Stage B - Installation of stone blanket over stone columns and adjacent filter layer on seabed and secondary armour layer over seabed.
- Stage H – Reclamation fill within the rock dyke.
- Stage I – Placement of precast concrete wave wall units (approximately 3 m long precast units at approximately 30 tonnes each) using crawler crane. Place final accropodes in position adjacent to the precast structure.
- Stage J – Ground improvement (such as vibrocompaction) of reclamation fill materials.
- Stage K – Construct airfield pavements.

The schedules will identify the potentially affected neighbours and confirm the proposed methodology and equipment to be used, along with specific mitigation.

Predictions of construction noise and vibration will be made using an appropriate methodology. These calculations will be used to identify where specific mitigation is required and to determine compliance with the project's noise criteria as specified in the relevant consent conditions.

The schedules will detail any specific monitoring or communication requirements.

The schedules will be read and signed by all site personnel involved in the work, prior to the activity commencing.

7.0 Management and Mitigation

7.1 Stakeholder engagement

A key aspect of this construction noise and vibration management plan is stakeholder engagement. WIAL have a stakeholder engagement management plan^[4] and the actions within that plan will be adhered to, together with the following:

- There will always be a contact person available on site, and their contact details will be prominently displayed at the entrance to the site so that they are clearly visible to the public.
- Prior to the works a newsletter or similar will be distributed to all neighbours within at least 1000 metres of the works. The newsletter will provide contact details and will detail the overall nature of the works. The same information will also be published in an advertisement in a local newspaper.
- Individual notification will be provided and meetings offered to all neighbours within 300 metres of the works. For any neighbours within approximately 100 metres of the works individual consultation will be continued throughout the works.
- Further information will be regularly provided to all neighbours with an update on the progress of the works, and the specific activities (including locations) due to be undertaken next. This may be provided by newsletters or possibly by email. Updates will be provided every two or three months.
- Prior to any particularly noisy processes identified in a construction noise management schedule, the nearest affected neighbours will be contacted individually. Neighbours will be informed of the proposed timing of the specific works and where practicable any times which are particularly sensitive for neighbours will be avoided.

7.2 Mitigation

7.2.1 General

The following general noise control measures are required to conform to good practice:

- Use of equipment in accordance with manufacturer's instructions / site protocols (method statements).
- Selecting equipment and methodologies to restrict noise.
- If possible, managing times of activities to avoid night works and other sensitive times.
- Liaising with neighbours so they can work around specific activities.

7.2.2 Specific

[Specific mitigation itemised here... for example.....]

7.2.2.1 Handling of materials

[Specific mitigation itemised here... for example.....]

7.2.2.2 Generators

An acoustics enclosure will be used around any site generators. The noise level from this item of equipment will be confirmed at the start of operation.

7.2.2.3 Reversing alarms

Broad band reversing alarms should be considered. Further information is available on the Transport Noise website (www.acoustics.nzta.govt.nz).

⁴ TBC

8.0 Monitoring

8.1 Noise

Noise monitoring shall be conducted by the following trained staff in accordance with NZS 6801:2008 and NZS 6803:1999:

- [Names]

The monitoring will be conducted using the dedicated sound level meter kit detailed below which will be stored in the Engineers Office for the duration of the project. The calibrator will be verified by an accredited laboratory annually and biannually for the sound level meter and microphone.

Table 7 Noise monitoring equipment

Equipment	Make	Model	Serial number	Verification date
Sound level meter and microphone	TBC	TBC	TBC	TBC

Monitoring will be conducted as follows,

- When the works start to verify the sound levels assumed for each of the major items of equipment and to assess the effectiveness of noise control measures and implementation of this plan.
- At regular intervals during the works, to check ongoing compliance with the construction noise criteria, including any works at night.
- If required, in response to construction noise related complaints.

Following each noise survey, the results will be reported to WIAL and any issues discovered will be investigated.

9.0 Complaints

WIAL's stakeholder engagement management plan^[4] will be followed regarding complaints, together with:

- a) All noise complaints should be immediately directed to [xxxxx].
- b) As soon as the complaint is received it will be recorded on the project complaints register.
- c) An initial response will be made and recorded. Depending on the nature of the complaint the initial response could be to immediately cease the activity pending investigation, or to replace an item of equipment. However, in some cases it might not be practicable to provide immediate relief. WIAL, complainant and council will be informed of actions taken. Contact details are recorded in Section 1.0 of this plan.
- d) Where the initial response does not address the complaint, further investigation, corrective action and follow-up monitoring shall be undertaken as appropriate. WIAL, complainant and council will be informed of actions taken.
- e) All actions will be recorded on the project complaints register and the complaint will then be closed.

10.0 Documentation

10.1 File

All files relating to construction noise will be kept in the Site Office. This will include:

- Section 1 – Construction noise management plans
 - This Construction Noise Management Plan and any revisions
 - Construction noise induction sheets
- Section 2 – Consultation and complaints registers
- Section 3 – Noise monitoring
 - Site survey sheets and associated aerial photographs
 - Site survey summary sheet
 - Survey reports
 - Survey and equipment operating procedures
 - Current and past equipment details and calibration summary
 - Copies of calibration certificates

10.2 Reporting

The following information will be provided within the timeframes stated.

Table 8 Information reporting requirements

Information	Timeframe
Construction Noise Management Plan	At least one week before works commence
Noise survey reports	Within one week of monitoring
Noise complaint initial report	Within twenty-four hours
Noise complaint closed	Within one week of closing complaint

Appendix A

Construction Noise Induction

Appendix A Construction Noise Induction

Project: WIAL Runway Extension

There are several residential neighbours to the works where noise criteria apply. To ensure criteria are achieved, all staff are responsible for good noise management.

- 1) When arriving at work, please drive slowly on site and keep revs to a minimum. Keep stereos off and do not slam doors.
- 2) No shouting or swearing on site. Either walk over and talk to somebody or use a radio/phone.
- 3) Be careful with tools and equipment. Place them down and do not drop them.
- 4) Do not drag materials on the ground. Place them down when you arrive at the work area.
- 5) Equipment and vehicles should not be left running when not in use.
- 6) When loading trucks try not to drop material from a height. Load softer material at the bottom and bed out the loading area.
- 7) Noise enclosures should always have all doors/hatches closed when the equipment is in use.
- 8) Stationary equipment such as pumps and generators should be located away from neighbours and if possible shielded using other equipment/containers.
- 9) All equipment is to be well maintained.
- 10) If you see anything/anyone making unnecessary noise then stop it/them. If the source cannot be stopped then report it to the Site Office.
- 11) It is essential that good relationships are maintained with the local community. Any queries from members of the public should be responded to politely and referred to [xxxxxxx]. Staff shall assist the public to make contact with this person. Staff shall not enter into debate or argue with members of the public.

Name	Company	Signed	Date