MARSHALL DAY Acoustics

PORT OF NAPIER
PORT NOISE CONTROL BOUNDARIES

Rp 002 r01 20190436 | 27 February 2020

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Project: **PORT NOISE CONTROL BOUNDARIES**

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Report No.: **Rp 002 r01 20190436**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft	-	For Information	12 Feb 2020	C Fitzgerald	S Wilkening
Issued	-	For consultation	27 Feb 2020	C Fitzgerald	-

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1.0 INTRODUCTION

The City of Napier District Plan (**NDP**) is under review, with notification expected in 2020. Port of Napier has engaged Marshall Day Acoustics Limited (**MDA**) to review the port noise contours which are used inform any revision of the NDP port noise provisions.

MDA first prepared a noise model for Port of Napier in 1994. This model has regularly been revised to reflect changes in operation, establish the City of Napier District Plan Port Noise Control Boundaries and evaluate western reclamation options to name a few.

Port of Napier is currently building Wharf 6 to support larger container ships and associated container volumes and forecasted increase in visiting cruise ships. This is part of a developing infrastructure master plan, with a view to enabling anticipated freight demand and visiting cruise ships and securing the long-term future growth for the region. More information on Port of Napier's Wharf 6 development and future growth scenarios can be found on their website www.napierport.co.nz.

Port noise contours have been modelled for the peak periods during current (**2020**) and future (**2035**) operational scenarios. The current scenario enables an understanding of the existing noise environment for benchmarking purposes. The future scenario enables evaluation of the Operative Port Noise Control Boundaries in accordance with the Port Noise Standard.

In summary:

- The Current Port Noise Maps (2020) are calibrated to a level of 62.4 dB $L_{dn\ (5\ day)}$ at the Noise Monitoring Terminal (**NMT**).
- The Future Port Noise Maps (2035) are predicted to be a similar shape to the Current Port Noise Maps (2020), but 1 – 2 decibels louder. Nonetheless, remain compliant with noise limits in Napier District Plan operative rule 28.15.1 part (a).
- Port Noise Boundaries based on the 2035 model would be largely unchanged from the operative alignments on Napier Hill, but significantly smaller in Ahuriri due to the removal of the western reclamation plans.
- We recommend the spatial average indoor design sound level for new, altered and existing dwellings be lowered to 40 dB $L_{dn\ (5\text{-}day)}$

A glossary of technical terms is included in Appendix A.

2.0 PORT NOISE STANDARD

2.1 Overview

The objective of NZS6809:1999 Acoustics – Port Noise Management and Land Use Planning (**Port Noise Standard**) is to ensure the long-term compatibility of ports and their neighbours by the application of appropriate land use planning techniques. The Standard recognises the need for ports to operate in an effective manner and provides guidelines to ensure that any adjacent residential communities can co-exist with ports and their associated activities. This is achieved in two parts:

- Noise Control Boundaries (land use controls to avoid reverse sensitivity associated with the 'hum' of port operations)
- Port Noise Management Plan (minimise noise effects within the port, such as 'banging' from log or container handling or reverse movements of forklifts, log and container handlers)

The primary focus of this report is the Noise Control Boundaries, but both parts are summarised in the following two sub sections.

2.2 Noise Control Boundaries

2.2.1 Noise Contours

The Port Noise Standard uses the concept of *Inner* and *Outer Noise Control Boundaries* which it recommends be incorporated into planning maps in the District Plan. Each boundary has an associated range of permitted and conditional activities.

The *Inner* and *Outer Control Boundaries* are based around an acoustic parameter called the *Day/Night Level* or L_{dn} which is measured in dBA. This parameter is essentially the energy average sound level calculated over a 24-hour period. Night-time noise is weighted by adding 10 decibels to reflect the greater sensitivity to noise at night. In the Port Noise Standard, the *Inner* and *Outer Noise Control Boundaries* equate to a predicted noise level over a 5-day period of 65 dBA L_{dn} and 55 dBA L_{dn} respectively.

Section 6.4.2 of the Port Noise Standard recommends that the location and extent of the Noise Control Boundaries should be determined with regard to:

a) "Port location and proximity to current or potential residential areas;

b) Port activity types (current and future);

c) Frequency of ship movement by type, time of day, duration of stay and expected berth location;

d) Variation in port activities within a year (e.g. due to seasonal factors);

e) Appropriate meteorological effects as set out in NZS 6801;

f) Current and future port capacity and any proposed port operations;

g) *Noise monitoring data; and*

h) The best practicable option for reduction of noise emissions."

2.2.2 Land Use Controls

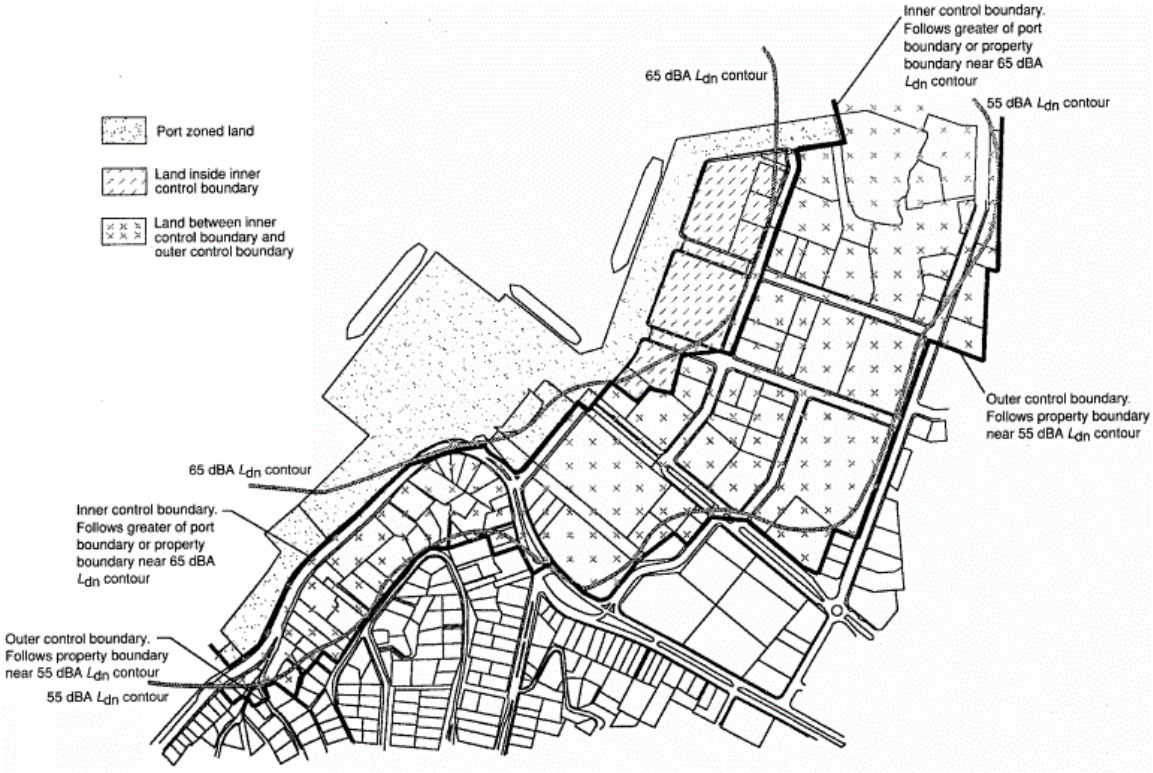
The Noise Control Boundaries are derived from the noise contours for the predicted peak operations period in the lifetime and review period of the District Plan, which is typically 10 – 15 years in the future.

The Noise Control Boundaries are determined based on predicted noise contours. The relationship between predicted noise contours and Noise Control Boundaries is illustrated in the example from NZS 6809: 1999, reproduced as Figure 1 overleaf. The Noise Control Boundaries are inclusive, following cadastral boundaries (i.e. if the relevant predicted noise contour cuts through part of the property, the whole property is included within the Boundary).

The NDP must include policies, objectives and rules with relevant standards, terms and conditions, to define the status of activities within the Noise Control Boundaries to achieve the purpose of the Port Noise Standard.

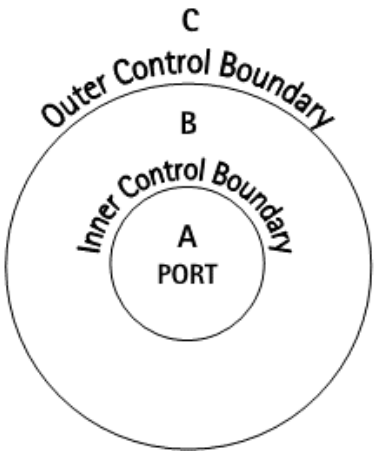
Any building or part of a building used for a noise sensitive activity with the Noise Control Boundaries should be required to be adequately insulated from port noise. As such, any room used for a noise sensitive activity should be designed to achieve an indoor sound level from port noise not exceeding 45 dB L_{dn}, with all the windows and doors closed.

Figure 1: Example of Inner and Outer Control Boundaries from Figure 1 of NZS6809: 1999)



The Port Noise Standard provides that following recommended rules for noise sensitive activities within the Noise Control Boundaries represented in Figure 2.

Figure 2: Control areas A, B and C from Figure 2 of NZS6809: 1999



Area A - Inside the Inner Control Boundary (i.e. noise levels above 65 dB L_{dn}):

- *"New noise sensitive activities should be prohibited.*
- *In exceptional circumstances new noise-sensitive activities could be discretionary activities subject to conditions requiring that buildings used for such activities be adequately insulated from port noise.*
- *Alterations or additions to existing buildings associated with noise-sensitive activities should be discretionary activities, subject to conditions requiring that alterations or additions to existing buildings used for noise-sensitive activities, be adequately insulated from port noise."*

Area B – Between the Inner and Outer Control Boundaries (i.e. 55 dB L_{dn} – 65 dB L_{dn}):

- *"New noise sensitive activities, and alterations or additions to existing buildings used for noise sensitive activities, should be permitted activities subject to conditions requiring that new buildings for alterations or additions to existing buildings used for noise-sensitive activities, be adequately insulated from port noise."*

Area C – Outside the Outer Control Boundary (i.e. noise levels less than 55 dB L_{dn})

- No recommended land use controls

2.2.3 Noise Limits

The Port Noise Standard recommends the noise limits in Table 1 for existing Ports. Note that the daytime period is 0700 – 2200 hours on any day, and the night-time period is 2200 – 0700 hours on the following day.

Table 1: Noise Limits for existing ports

Location	Day-night (Long term)	Night-time (Short term)
At any point on land at, or beyond, the inner control boundary (i.e. beyond Area A)	65 dB $L_{dn\ (5\text{-}day)}$ 68 dB $L_{dn\ (1\text{-}day)}$	60 dB $L_{Aeq\ (9\ hrs)}$ 65 dB $L_{Aeq\ (15\ min)}$ 85 dB L_{AFmax}

2.3 Port Noise Management Plan

The Port Noise Standard recommends that a Port Noise Management Plan (**NMP**) should be developed to complement the proposed Port Noise Control Boundaries and associated planning restrictions. It states: "*The need for a management plan recognises that noise levels adjacent to the port may at times be higher than desirable."* The Port Noise Standard provides guidance on the development and application of an NMP to "*ensure that emissions of noise from port activities is minimised, consistent with practicality, safety and the efficient operation, use and development of the ports*".

Port of Napier has implemented a Noise Management Plan (NMP) in accordance with the requirements of NZS 6809: 1999 and NDP rule 28.15.1 (b). The current version of the NMP is available on the Port of Napier website: http://www.napierport.co.nz/community/sustainability/. The remainder of this report is focused on the implementation of Noise Control Boundaries (Section 2.2).

3.0 PLANNING STANDARDS

3.1 City of Napier District Plan (Operative)

Chapter 57 presents the city-wide policies and objectives on noise. It refers to the specific port noise rules in Chapter 28, but notes the following relevant general commentary in the introduction:

> "*The varying noise levels which exist in Napier City do give rise to the potential for conflict where, for instance, industrial activities and residential areas adjoin one another and expectations for what is an acceptable acoustic environment are at variance. In these circumstances, consideration should be given to the need for effective sound insulation for new dwellings and existing dwellings undergoing renovations to protect the occupants from high background noise levels.*
>
> *The purpose of the District Plan is to provide a regime in which the management of noise generation is made possible in order to protect the amenity of the community, as well as enabling those activities which have noise associated with them to operate in a practical environment.*"

Chapter 28 contains the rules managing land uses in the Port Industrial Zone. Noise rule 28.15.1 is included in Appendix B and summarised as follows:

- Part (a) adopts the recommended port noise limits from NZS 6809 reproduced in Section 2.2.3, Appendix B. These limits apply at the Inner Port Noise Boundary shown in planning maps F7 and F8.
- Parts (b) – (f) relate to noise monitoring, mitigation, management and liaison with respect to the Current Port Noise Maps. The Current Port Noise Maps are updated annually to reflect operations in accordance with the provisions of the Port Noise Standard. The latest revision of the Current Port Noise Maps (2019) is discussed in Section 4.5.

The operative Port Noise Boundaries extend into the Harginge Road Residential and Northern Residential areas at the east end of Ahuriri, and Napier Character Hill Residential on the north side of Napier Hill (refer planning maps F7 and F8). Accordingly, port noise is discussed as a significant management issue for Residential Environments in Chapters 4. Commentary from 4.1.7 is reproduced below:

> *"**4.1.7. Some residential activities are adversely affected by non-residential activities outside the residential environment.***
>
> *Where different land uses are located adjacent to each other there is the potential for conflict. Where sensitive activities locate near existing activities like ports, airports and motorways there is the potential for the sensitive activities to be affected by those existing activities and to seek to restrain their operation. Such conflict forms the justification for management of sensitive activities on the basis of reverse sensitivity (e.g. requiring noise insulation as part of a new building).*
>
> *A different level of amenity can be experienced where a new residential activity is located adjacent to an existing rural, commercial or industrial zone. Similarly a different level of amenity in the residential environment can be experienced adjacent to major regional infrastructure such as the Port, Airport and Hawke's Bay Expressway. In some situations, these non-residential activities must be regarded as permanent, and their effects may increase over time as a result of reasonable future use and growth.*
>
> *Residents overlooking or near to the Port, Airport or Hawke's Bay Expressway should be aware that the level of effects will not be the same as experienced in other residential areas of the City. Special noise standards are appropriate, permitting these facilities to continue to operate and develop while recognising their adverse effects on nearby noise sensitive activities."*

New or altered dwellings within the Port Noise Boundary (excluding those in the Port Inner Noise Boundary) have minimum sound insulation requirements in rules 6.27.2, 7.26.2 and 8.22.2 (the rules are repeated for each of the relevant residential zones).

New or altered dwellings and other new noise sensitive activities in the Port Inner Noise Boundary are controlled activities, addressed by rules 6.12 – 6.14 and 7.13 as appropriate.

3.2 Hawke's Bay Regional Coastal Environment Plan (Operative)

The Hawke's Bay Regional Coastal Environment Plan (**RCEP**) Policies in Chapter 25 and Rule 177 align with equivalent controls in the Napier District Plan provisions discussed in Section 3.1.

3.3 National Planning Standards

Chapter 15 of the National Planning Standards (**NPS**)[1] titled 'Noise and Vibration Metrics Standard' requires: "*Any plan rule to manage noise emissions must be in accordance with the mandatory noise measurement methods and symbols in the applicable New Zealand Standards incorporated by reference into the planning standards and listed below*". The two standards of relevance are:

- New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound
- New Zealand Standard 6809:1999 Acoustics – Port noise management and land use planning

The Operative NDP has already implemented NZS 6809:1999, including the necessary measurement and assessment provisions, and the recommended port noise limits and land use controls within established Port Noise Control Boundaries. These aspects are discussed in more detail in Section 2.0.

[1] Ministry for the Environment. 2019. National Planning Standards. Wellington: Ministry for the Environment. https://www.mfe.govt.nz/sites/default/files/media/RMA/national-planning-standards-november-2019.pdf

Any revision of the NDP port noise rules must continue to refer to the measurement and assessment methods in the Standards above. Beyond this, an NPS supporting document titled 'Guidance for 15. Noise and Vibration Metrics Standards' notes "*it does not provide direction for plan content such as noise limits*" but recommends "*the standards should be read as a whole, to provide context for specific provisions*".

4.0 MODELLING METHODOLOGY

4.1 Overview

A computer-based noise model was used to predict the 'energy average' noise emissions from the Port over a peak 5-day operating period. The model consisted of the following parts that must be accurate in order for the noise contours to be reliable. The parts are summarised below and expanded on further in the following subsections:

- **Noise sources**
  The equipment reference noise levels are representative. Measurements have been made of representative Port machinery to determine the sound power levels in the model.
- **Operational scenario**
  The operational assumptions are representative, including the location of sources and their operational duration. These assumptions have been developed, and reviewed, with the Port on a regular basis since 1994.
- **Modelling methodology**
  The software takes into account attenuation due to distance, shielding, ground absorption, topography, air absorption and assigns the +10 decibels night weighting for the L_{dn} index. It enables both individual and cumulative assessment of noise emissions.
- **Calibration**
  The model relies on short-term and long-term monitoring to verify the shape of the overall level of the contours and calibrate the model.

4.2 Noise Sources

The noise source data for the model was prepared from representative machinery data measured at other New Zealand ports.

In every case, the octave band spectrum of the noise source was measured at a known distance while the equipment undertook several cycles of operation. From this data, the sound power level of the equipment was calculated. The calculated sound powers were cross checked against data for similar equipment. Table 2 summarises the sources used in the noise model.

Table 2: Noise sources used in the operational noise models

Noise Sources used in Model*	Sound Power Level (dB L_{wA})
Cranes	110 – 115
Ships at berth (e.g. log, container, cruise ships)	105 – 115
Straddle carriers, log loaders and trucks	100 – 110
Small fork-lifts	90 – 100
Reefer units	85 – 90

* Vehicles on public roads and train movements are excluded from port noise contours

4.3 Operational Scenario

The Current Port Noise Maps are produced from the busy 5-day operational scenario model. The operational assumptions are essential to ensure the model reflects the representative peak 5-day period of cargo throughput or activity.

The modelling assumptions include a description, the number, and an equivalent 'on-time' description for each noise source. The 'on-time' operational profile is explained by way of the following four examples from Figure 4 of the Current Port Noise Maps (2020) in Appendix C:

- Item A1: 'Log trucks (east gate – log yard)'
  This represents truck movements between the east gate and log yard on Wharf 1, where two movements are required for one return trip. The average '5-day movements' for the noise source is split into day (0700-2200) and night (2200-0700) periods to enable application of the night weighting in the L_{dn} index. The sound power level of one truck is modelled travelling along the line shown in Figure 4 at an average speed of 15km/hr. The number of movements is input as 728 trucks movements per day and 56 movements per night over the 5-day peak period.
- Item A2: 'Log Loaders (truck unloading)'
  This represents log loaders operating on Wharf 1. The sound power level of each unit is included at various representative locations identified in Figure 4. The daytime 'on-time' summary description '75% 13h 5d' indicates that the equipment is typically utilised 75% of an activity period spanning 13 hours on all 5 days. There are 5 of these sources included in the model, as denoted in the 'No.' column.
- Item E1: 'Reefers (24 chiller units stack 6wx4h)'
  This represents a stack of 24 reefer units, arranged 6 units wide by 4 units high. The cumulative sound power level for 24 units is evenly distributed over one end of the stack, facing the tower that provides electricity to the units. The location of the stacks is shown in Figure 4. The 'on-time' takes into account typical duty cycle times.
- Item E5: 'Reach Stackers (R&D / Depot - 8 units)'
  This represents 8 reach stackers operating in the container terminal. The cumulative sound power level is for 8 units evenly distributed over its region of operation shown in Figure 4.

4.4 Modelling Methodology

The noise model has been prepared using SoundPLAN, an internationally recognised computer noise modelling programme. SoundPLAN uses a digital topographical terrain map of the area as its base. Each noise source is located at an appropriate height above the digital map and the software then calculates noise propagation in multiple directions, allowing for buildings, topography, shielding, reflections and meteorological conditions.

SoundPLAN uses the calculation algorithms of ISO 9613-2: 1996 'Acoustics – Attenuation of noise during propagation outdoors – Part 2: General method of calculation'. Its accuracy has been established by field trials, including comparisons in New Zealand between predictions and measurements.

The model relies on the following geo referenced base data sourced from Napier City Council (2015):

- Topographical contours at 1m intervals
- Cadastral boundaries
- Building outlines and heights
- Street numbers and names
- Geo referenced aerial imagery

The noise contours are obtained by computer interpolation between calculated grid points at 10m intervals. This ensures that there is at least one data point on each parcel of residential land assuming a 20m x 20m parcel size.

The façade noise maps on buildings are calculated grid points at 3m intervals, starting at 1.5m above ground level. This ensures grid points at each level vertically, as well as spatial representation horizontally, across each building's façades.

4.5 Calibration

MDA has undertaken attended noise monitoring to verify the shape of the modelled noise contours, and annually reviews noise monitoring data to calibrate the Current Port Noise Maps. The most recent annual monitoring review report[2] was for the year ending 30 June 2019.

The annual review is based on the measured ambient noise levels at the Bluff Hill Noise Monitoring Terminal (**NMT**), located near 3 Karaka Road. The Bluff Hill NMT is considered to provide a good point of reference for port noise levels received in the community. The NMT captures audio recordings of loud noise events to enable identification of the source and ensure validity of the measured data. It also enables identification of high noise sources for management purposes.

The peak 5-day period of port noise is consistently in March each year. The level during the peak period has remained relatively constant for the last 8 years, with fluctuations of +/-1 decibel that can be expected from year to year and are within monitoring and reporting tolerances. In short, activity intensity has increased, but noise levels have remained static due to investment in quieter equipment, changes to port layout and operations management.

Port noise continues to comply with the 65 dB $L_{dn\ (5\ day)}$ and 68 dB $L_{dn\ (1day)}$ noise limits in NDP rule 28.15.1 (a). The highest port-controlled period in recent years measured 62.4 dB $L_{dn\ (5\ day)}$ at the NMT for the period 15 to 20 March 2016. Note noise levels are normally reported to the nearest whole number, however, to aid transparency, the level is presented to one decimal place. The Current Noise Maps predict 62.4 dB $L_{dn\ (5\ day)}$ at the NMT, so no model calibration is required. While convenient, exact correlation is not necessary or reasonably expected. Note that ± 2 dBA accuracy would normally be expected and is considered acceptable for environmental noise predictions.

The results of an attended noise survey in 2012 have also been used to verify the shape of the modelled noise contours at multiple locations. The agreement between predicted and measured contours is excellent (± 1 dBA) at receiver positions with line of sight to the operations.

The future noise model (2035) leverages from the current noise model (2020) with the same noise sources, operational assumptions (adjusted for forecast growth) and modelling parameters and calibration adjustment.

Overall, it is considered that the noise model provides an accurate representation of both the current and future peak operating periods.

5.0 PORT NOISE MAPS

5.1 Noise Contours

The Current Port Noise Maps (2020) are included in Appendix C and the Future Port Noise Maps (2035) are included in Appendix D. Overall, the future (2035) noise contours are predicted to be approximately the same shape as the current (2020) noise contours, but 1 – 2 decibels louder.

For each set of noise maps, the Figures are summarised as follows:

[2] MDA report titled 'Port of Napier Current Port Noise Maps 2019', Rp 002 20190436, dated 9 September 2019

- Figures 1A and 1B: The noise contours at 1.5m above ground level enable comparison with noise survey measurements undertaken in accordance with New Zealand Standard NZS 6801:2008 "Acoustics – Measurement of environmental sound", which is the revision of the 1999 version referred to in rule 28.15.1 (f).
- Figures 2A and 2B: The noise contours at 4m above ground level align with the Bluff Hill NMT microphone height. This may also represent the noise level received at the upper level of a double story dwelling with good sight lines of Port activities.
- Figures 3A, 3B and 3C: The 3D façade noise map predicts noise levels received at the façades of existing dwellings. The plan view façade noise maps display the highest noise level received on the façades. This is useful for amenity or sound insulation purposes.
- Figure 4: Presents the modelling inputs and assumptions.

The facade noise map building types categories are as follows:

- Residential Building
- Residential Building (Insulated)
- Industrial Building

Residential Buildings (Insulated) include:

- New dwellings within the Port Outer Noise Boundary.
  NCC supplied a list of Resource Consents to identify new dwellings since the port noise provisions were originally notified in 2003[3]. A further new dwelling has recently been consented and built at 16 Hornsey Road. These dwellings are currently not eligible for the Port Noise Mitigation in NDP Appendix 33B.
- Modifications or extensions to existing dwellings.
  The NCC list of Resource Consents was less conclusive for this purpose. Depending on the works undertaken, the dwelling may still be eligible for the Port Noise Mitigation in NDP Appendix 33B in full, in part, or not at all. Therefore, no dwellings have been categorised as Residential Buildings (Insulated) on this basis alone. It is assumed they remain eligible unless Council records demonstrate otherwise.
- Port Napier mitigated dwellings (offered to houses between 60 and 65 dB $L_{dn\ 5\text{-}day}$).
  These are dwellings that have been mitigated in accordance with the Port Napier noise mitigation scheme set out in Section 5.1 of the Port Noise Management Plan.

5.2 Noise Boundaries

Figure 5 of the Future Port Noise Maps (2035) in Appendix D compares the operative Port Noise Boundaries and an alternative proposed set to align with 2035 modelling results in accordance the Port Noise Standard (refer Section 2.2).

The proposed boundaries are largely unchanged on Napier Hill, but significantly smaller in Ahuriri. The primary reason for this difference is the operative plan boundaries were based on a scenario that envisaged a fully expanded and operational western reclamation. The western reclamation was not completed and is not proposed in the future master planning period either. It also reflects a combination of improvements to the port layout, equipment, operations, noise modelling and noise management.

In summary:

[3] Plan Change 410, Port Noise Provisions, Notified 16 April 2003 (Operative 1 June 2009)

- The 2035 inner boundary alignment would reduce the number of residential sites and not include any new residential sites.
- The 2035 outer boundary alignment would significantly reduce the number of residential sites to the west in Ahuriri. However, there is an additional residential site at 4 Kowhai Road and a further 10 on the eastern face of Napier Hill overlooking the east gate traffic movements to/from SH50.

5.3 Sound Insulation Requirements

5.3.1 New noise-sensitive activities

Any new noise-sensitive activity (e.g. dwelling), or alteration or addition to an existing building used for a noise sensitive activity, within the Outer Noise Control Boundary, should be adequately insulated from port noise. We recommend that this should be achieved by constructing the building to achieve a spatial average indoor design sound level of 40 dB $L_{dn\ (5\text{-}day)}$ in all habitable spaces. This recommendation is 5 decibels more stringent than the Port Noise Standard requirement for existing ports of 45 dB $L_{dn\ (5\text{-}day)}$ (Section 2.2.2) and existing NDP requirements (Section 3.1). This deviation would further improve internal amenity and reduce reverse sensitivity effects.

The indoor design level should be achieved with windows open to provide ventilation unless adequate alternative ventilation is provided and maintained in operating order. The incident design should be based on future noise contours shown in Figures 1B and 2B in Appendix D. The sound insulation design must be certified by a suitably qualified acoustic engineer. The completed construction must be certified by the builder as built in accordance with the design.

Where windows in habitable rooms need to be closed to enable compliance, provision of forced air ventilation may be required, as well as cooling to regulate thermal comfort.

5.3.2 Existing noise-sensitive activities

Table 3 summarises the predicted number of existing dwellings eligible for port noise mitigation schemes in NDP Appendix 33B and Port Noise Management Plan Section 5.1.

Table 3: Dwellings in the Port Noise Boundaries

Façade Noise Level	Current (2020)	Future (2035)	Noise Mitigation Scheme
> 68 dB $L_{dn\ (5\ day)}$ 'purple' zone	0	0	Not relevant
65 – 68 dB $L_{dn\ (5\ day)}$ 'red' zone	0	7	NDP Appendix 33B (if not already mitigated below)
60 – 65 dB $L_{dn\ (5\ day)}$ 'yellow' zone	21	31	Port Noise Management Plan Section 5.1: - 13 mitigated, or in the process of - 5 offered but not accepted or not elegable - Others to be considered annually as appropriate
55 – 60 dB $L_{dn\ (5\ day)}$ 'green' zone	37	51	Not eligable

There are approximately 58 dwellings between the Inner and Outer Port Noise Control Boundaries shown in the Current Noise Maps in Appendix C. This is predicted to rise to 82 dwellings by 2035.

Most of these dwellings are predicted to receive noise levels in the range of 55 – 60 dB $L_{dn\ (5\text{-}day)}$. They would generally achieve the Port Noise Standard recommendation for existing ports of 45 dB L_{dn} in habitable spaces without any specific sound insulation improvements. However, we recommend the spatial average indoor design sound level should be lowered to 40 dB $L_{dn\ (5\text{-}day)}$ as per the requirements for new dwellings in Section 5.3.1 above. This recommendation aligns with the Port Napier noise mitigation scheme extension detailed in the Port Noise Management Plan Section 5.1.

Commenced in 2016, 13 dwellings have received sound insulation upgrades through the voluntary scheme, which applies to the most exposed dwellings between 60 – 65 dB $L_{dn\ (5\text{-}day)}$.

The implementation of the mitigation requirements are informed by the periodic review of the current port noise contours. Therefore, upgrades of existing dwellings would only be triggered when the noise effects materialise. This incentivises Port of Napier to constrain their noise footprint through other means. For example, investing in quieter machinery and relocation of high noise generating activities away from dwellings where practicable and safe to do so. This approach has resulted in overall port noise levels remaining stable while increasing throughput.

6.0 CONCLUSIONS

The NPS requires the application of the Port Noise Standard. The Standard recognises the need for ports to operate in an effective manner and provides guidelines to ensure that any adjacent residential communities can co-exist with ports and their associated activities. This is achieved in two parts:

- Noise Control Boundaries (land use controls to avoid reverse sensitivity associated with the 'hum' of port operations)
- Port Noise Management Plan (minimise noise effects within the port, such as 'banging' from log handling)

Port noise contours for 'current' (2020) and 'future' (2035) operational scenarios have been prepared to represent the 'hum' of port operations during peak periods. The current scenario enables an understanding of the existing noise environment for benchmarking purposes. The future scenario identifies Port Noise Control Boundaries that would enable the master plan envisaged in accordance with the Port Noise Standard.

The Port of Napier noise model is the result of a comprehensive review of the modelling assumptions (noise sources, port operations, modelling methodology and calibration). It is considered that the noise model provides an accurate representation of current and future port noise emissions during peak operating periods.

In summary:

- Port of Napier is predicted to remain compliant with noise limits in Napier District Plan operative The Current Port Noise Maps (2020) are calibrated to a level of 62.4 dB $L_{dn\ (5\ day)}$ at the NMT.
- The Future Port Noise Maps (2035) are predicted to be a similar shape to the Current Port Noise Maps (2020), but 1 – 2 decibels louder. Nonetheless, remain compliant with noise limits in Napier District Plan operative rule 28.15.1 part (a).
- Port Noise Boundaries based on the 2035 model would be largely unchanged from the operative alignments on Napier Hill, but significantly smaller in Ahuriri due to the removal of the western reclamation plans.
- We recommend the spatial average indoor design sound level for new, altered and existing dwellings be lowered to 40 dB $L_{dn\ (5\text{-}day)}$.

APPENDIX A GLOSSARY OF TECHNICAL TERMINOLOGY

NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of environmental sound"*
NZS 6809:1999	New Zealand Standard NZS 6809:1999 "Acoustics – Port Noise Management and Land Use Planning"
dB	Decibel. The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
L_{dn}	The day night noise level which is calculated from the 24 hour L_{Aeq} with a 10 dB penalty applied to the night-time (2200-0700 hours) L_{Aeq}.
L_P or SPL	Sound Pressure Level. A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 μPa RMS) and expressed in decibels.
L_W or SWL	Sound Power Level. A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
Noise	A sound that is unwanted by, or distracting to, the receiver.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
Special Audible Characteristics	Distinctive characteristics of a sound which are likely to subjectively cause adverse community response at lower levels than a sound without such characteristics. Examples are tonality (e.g. a hum or a whine) and impulsiveness (e.g. bangs or thumps). In this case, port noise limits are set specifically for port noise character. Therefore, port noise character would be reasonably expected and not 'special' (e.g. would not apply to log or container handling activities).

APPENDIX B NAPIER DISTRICT PLAN, PORT INDUSTRIAL ZONE, RULE 28.15

28.15 **Noise** 1. The following noise conditions shall apply to all land uses, other than those exempted in Rule 57.5 and container repair, and maintenance activities (See Rule 28.15.2 below): a) All land uses within the zone must be conducted so as to ensure the following noise limits are not exceeded at any point beyond the Port Inner Noise Boundary shown on the planning maps: Over any 5 consecutive day period L_{dn} 65 dBA On any day L_{dn} 68 dBA 2200 hours to 0700 hours the following day $L_{eq\ (9hour)}$ 60 dBA $L_{eq\ (15min)}$ 65 dBA 2200 hours to 0700 hours the following day L_{max} 85dBA NOTE: To demonstrate non-compliance it shall only be necessary to show non-compliance with any one noise limit. b) The Port Operator shall include in a Port Noise Management Plan minimum monitoring and reporting requirements for noise management as set out in Appendix 33A.	Matters: - The sound level likely to be generated. - The nature and frequency of the noise including any special audible characteristics. - The effects of noise on amenity values. - The length of time for which specified noise levels is exceeded, especially at night. - The likely adverse effects beyond the zone. - The mitigation measures to reduce noise generation. - Whether an acoustic insulation treatment offer has been made to affected noise sensitive activities. - In the case of an acoustic insulation offer being made the likely effectiveness of the acoustic insulation in mitigating noise within habitable spaces to an acceptable level.
c) Where any noise sensitive activity is partly or wholly contained within the area seaward of a noise contour line that is 65 dBA L_{dn} (5 day average) as shown on the current Port Noise Contour Map attached to the Port Noise Management Plan; or Where sound level monitoring indicates that port noise equals or exceeds 65 dBA L_{eq} (15 minutes 10pm-7am) on more than three occasions (more than 24 hours apart) during any rolling 12 month period within the boundary of a noise sensitive activity: The Port Operator shall comply with the matters set out in Appendix 33B(1). d) Where any noise sensitive activity is partly or wholly contained within the area seaward of a noise contour line that is 68 dBA L_{dn} (5 day average) as shown on the current Port Noise Contour Map attached to the Port Noise Management Plan; or Where sound level monitoring indicates that port noise equals or exceeds 68 dBA L_{eq} (15 minutes 10pm-7am) on more than three occasions (more than 24 hours apart) during any rolling 12 month period within the boundary of a noise sensitive activity: The Port Operator shall comply with the matters set out in Appendix 33B(2). e) The Port Operator shall establish, maintain and participate in a Port Noise Liaison Committee which shall operate in accordance with the requirements set out in Appendix 33C. f) Noise must be measured in accordance with the provisions of New Zealand Standard NZS6801:1999 "Acoustics: Measurement of Environmental Sound" and New Zealand Standard NZS6809:1999 "Acoustics: Port Noise Management and Land Use Planning".	

APPENDIX C CURRENT PORT NOISE MAPS (2020)

- Figure 1A Noise Contours 1.5m above ground (5 decibel intervals)
- Figure 1B Noise Contours 1.5m above ground (1 decibel intervals)
- Figure 2A Noise Contours 4m above ground (5 decibel intervals)
- Figure 2B Noise Contours 4m above ground (1 decibel intervals)
- Figure 3A Façade Noise Map (1 decibel intervals 3D perspective)
- Figure 3B Façade Noise Map (5 decibel intervals plan view)
- Figure 3C Façade Noise Map (1 decibel intervals plan view)
- Figure 4 Model 5-day Operational Scenario

Noise level
(dB $L_{dn\ 5\text{-}day}$)

55
60
65

Port Noise Control Boundaries

Operative Inner Port Noise Boundary

Operative Outer Port Noise Bournary

Breakwater Rd (SH50)

Hardinge Rd

Waghorne St

Ahuriri Bypass (SH50)

Kenny Ave

Battery Rd

Outram St

Seaspray Rd

Thompson Rd

Cobden Rd

Lighthouse Rd

Kennedy Rd

Hornsey Rd

MARSHALL DAY Acoustics

Port of Napier Current Port Noise Maps (2020)
Figure 1A: Noise contours 1.5m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 1B Noise Contours at 1.5m.SGS, Result file: RRLK0502.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000

0 25 50 100 150 m

N

MARSHALL DAY Acoustics

Port of Napier Current Port Noise Maps (2020)
Figure 1B: Noise contours 1.5m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 1B Noise Contours at 1.5m.SGS, Result file: RRLK0502.res, Prepared: cmf, Date: 27 Frb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N

MARSHALL DAY Acoustics

Port of Napier Current Port Noise Maps (2020)
Figure 2A: Noise contours 4m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 2A Noise Contours at 4m.SGS, Result file: RRLK0503.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N

Noise level
(dB $L_{dn\ 5\text{-}day}$)

55
56
57
58
59
60
61
62
63
64
65
66
67
68

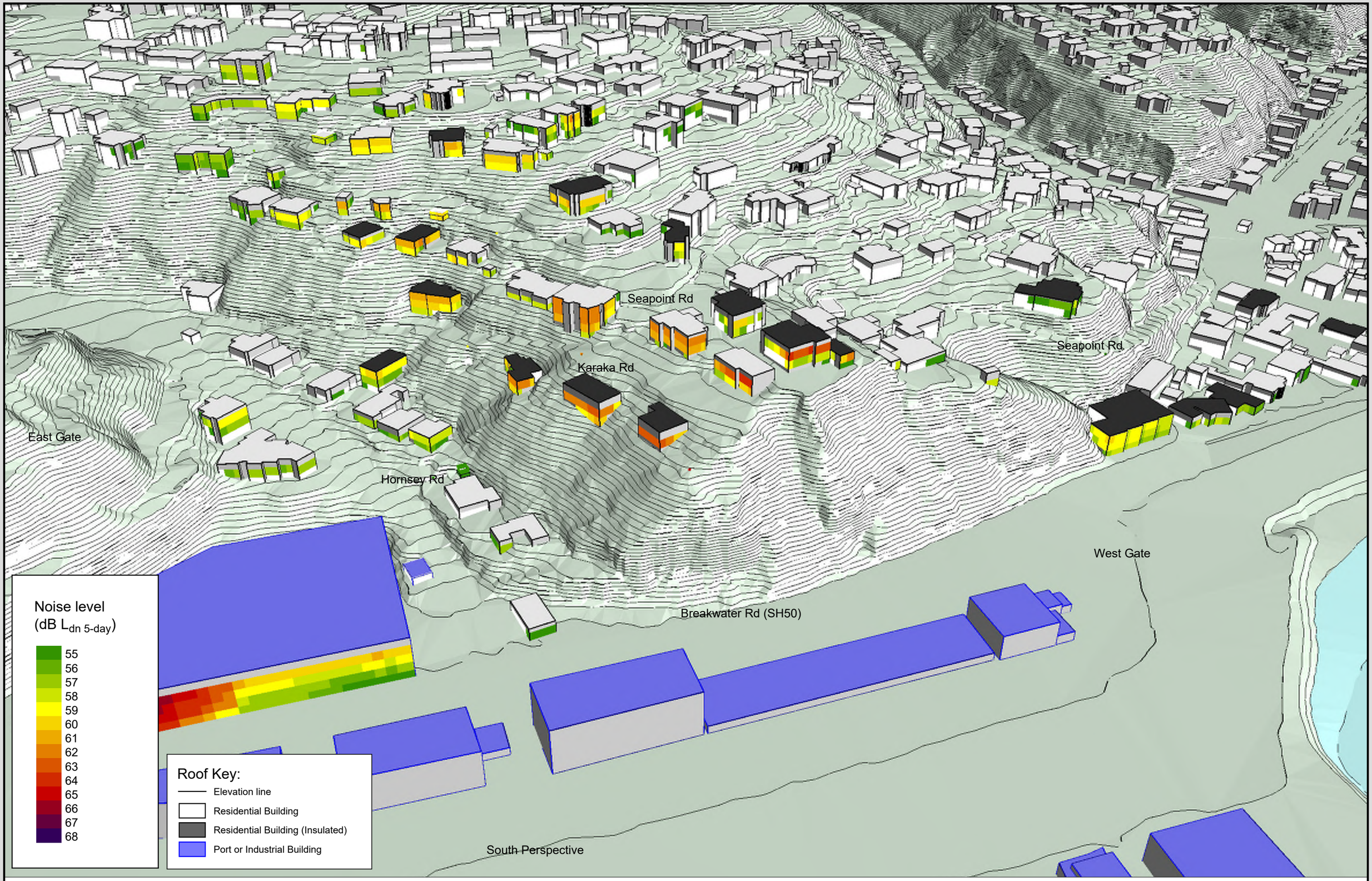
Breakwater Rd (SH50)
Hardinge Rd
Waghorne St
Ahuriri Bypass (SH50)
Kenny Ave
Outram St
Battery Rd
Shakespeare Rd
Thompson Rd
Gobden Rd
Lighthouse Rd

MARSHALL DAY Acoustics

Port of Napier Current Port Noise Maps (2020)
Figure 2B: Noise contours 4m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 2B Noise Contours at 4m.SGS, Result file: RRLK0503.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N



MARSHALL DAY Acoustics

Port of Napier Current Port Noise Maps (2020)
Figure 3A: Facade Noise Map

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 3A Facade Noise Map.SGS, Result file: RRLK0504.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Noise level
(dB $L_{dn\ 5\text{-}day}$)

55 - 60
60 - 65
65 - 68
>= 68

Buildings:

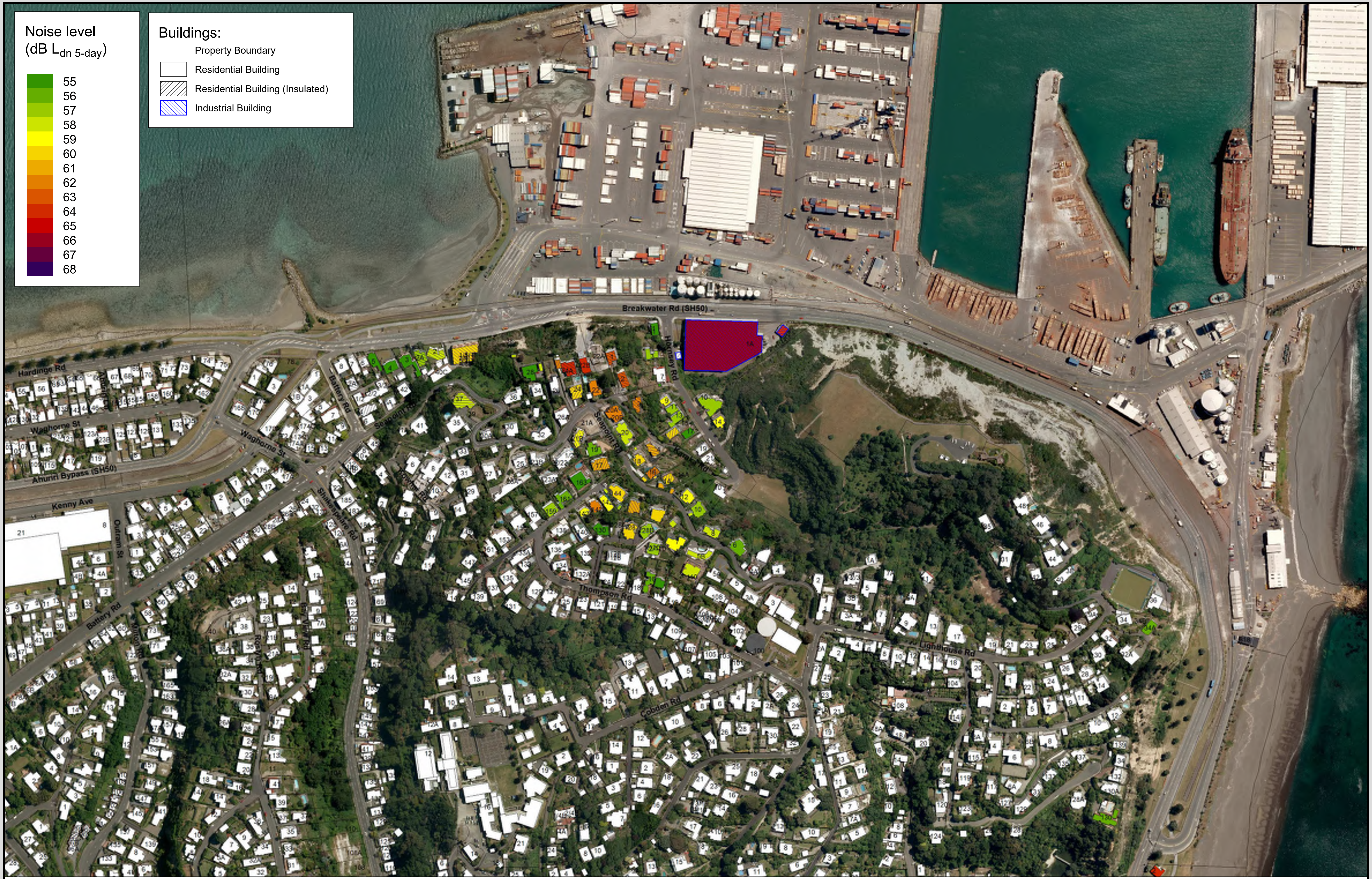
Property Boundary
Residential Building
Residential Building (Insulated)
Industrial Building

Breakwater Rd (SH50)
Hardinge Rd
Waghorne St
Amuriri Bypass (SH50)
Kenny Ave
Battery Rd
Outram St
Shakespeare Rd
Seaspray Rd
Thompson Rd
Cobden Rd
Lighthouse Rd
Hornsey Rd
Kennedy Rd
1A
21A

Port of Napier Current Port Noise Maps (2020)
Figure 3B: Facade Noise Map

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 3B Facade Noise Map.SGS, Result file: RRLK0504.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m



MARSHALL DAY Acoustics

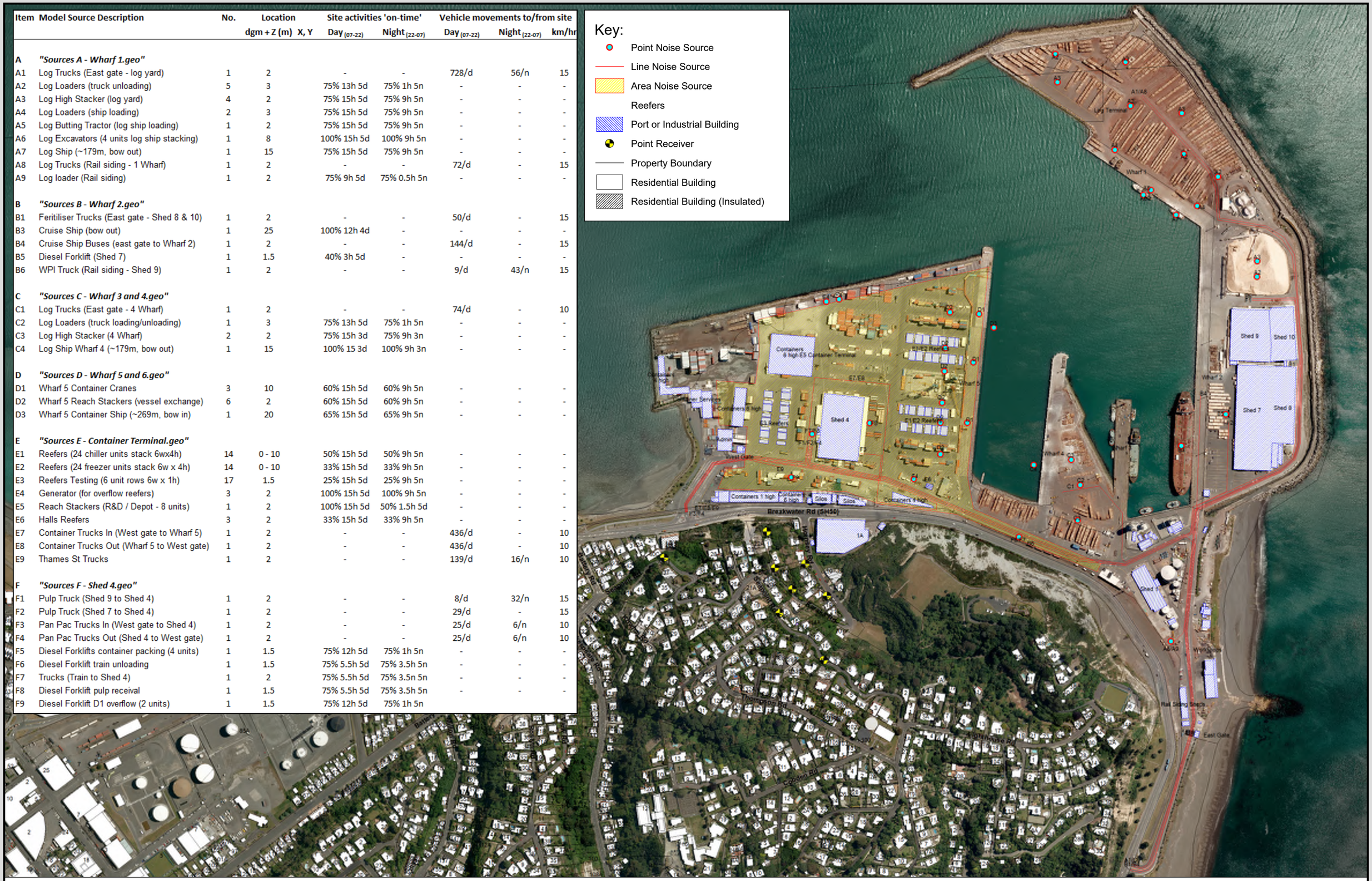
Port of Napier Current Port Noise Maps (2020)

Figure 3C: Facade Noise Map

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 3C Facade Noise Map.SGS, Result file: RRLK0504.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N

Item	Model Source Description	No.	Location dgm + Z (m)	X, Y	Site activities 'on-time' Day (07-22)	Night (22-07)	Vehicle movements to/from site Day (07-22)	Night (22-07)	km/hr
A	***"Sources A - Wharf 1.geo"***								
A1	Log Trucks (East gate - log yard)	1	2		-	-	728/d	56/n	15
A2	Log Loaders (truck unloading)	5	3		75% 13h 5d	75% 1h 5n	-	-	-
A3	Log High Stacker (log yard)	4	2		75% 15h 5d	75% 9h 5n	-	-	-
A4	Log Loaders (ship loading)	2	3		75% 15h 5d	75% 9h 5n	-	-	-
A5	Log Butting Tractor (log ship loading)	1	2		75% 15h 5d	75% 9h 5n	-	-	-
A6	Log Excavators (4 units log ship stacking)	1	8		100% 15h 5d	100% 9h 5n	-	-	-
A7	Log Ship (~179m, bow out)	1	15		75% 15h 5d	75% 9h 5n	-	-	-
A8	Log Trucks (Rail siding - 1 Wharf)	1	2		-	-	72/d	-	15
A9	Log loader (Rail siding)	1	2		75% 9h 5d	75% 0.5h 5n	-	-	-
B	***"Sources B - Wharf 2.geo"***								
B1	Feritiliser Trucks (East gate - Shed 8 & 10)	1	2		-	-	50/d	-	15
B3	Cruise Ship (bow out)	1	25		100% 12h 4d	-	-	-	-
B4	Cruise Ship Buses (east gate to Wharf 2)	1	2		-	-	144/d	-	15
B5	Diesel Forklift (Shed 7)	1	1.5		40% 3h 5d	-	-	-	-
B6	WPI Truck (Rail siding - Shed 9)	1	2		-	-	9/d	43/n	15
C	***"Sources C - Wharf 3 and 4.geo"***								
C1	Log Trucks (East gate - 4 Wharf)	1	2		-	-	74/d	-	10
C2	Log Loaders (truck loading/unloading)	1	3		75% 13h 5d	75% 1h 5n	-	-	-
C3	Log High Stacker (4 Wharf)	2	2		75% 15h 3d	75% 9h 3n	-	-	-
C4	Log Ship Wharf 4 (~179m, bow out)	1	15		100% 15 3d	100% 9h 3n	-	-	-
D	***"Sources D - Wharf 5 and 6.geo"***								
D1	Wharf 5 Container Cranes	3	10		60% 15h 5d	60% 9h 5n	-	-	-
D2	Wharf 5 Reach Stackers (vessel exchange)	6	2		60% 15h 5d	60% 9h 5n	-	-	-
D3	Wharf 5 Container Ship (~269m, bow in)	1	20		65% 15h 5d	65% 9h 5n	-	-	-
E	***"Sources E - Container Terminal.geo"***								
E1	Reefers (24 chiller units stack 6wx4h)	14	0 - 10		50% 15h 5d	50% 9h 5n	-	-	-
E2	Reefers (24 freezer units stack 6w x 4h)	14	0 - 10		33% 15h 5d	33% 9h 5n	-	-	-
E3	Reefers Testing (6 unit rows 6w x 1h)	17	1.5		25% 15h 5d	25% 9h 5n	-	-	-
E4	Generator (for overflow reefers)	3	2		100% 15h 5d	100% 9h 5n	-	-	-
E5	Reach Stackers (R&D / Depot - 8 units)	1	2		100% 15h 5d	50% 1.5h 5d	-	-	-
E6	Halls Reefers	3	2		33% 15h 5d	33% 9h 5n	-	-	-
E7	Container Trucks In (West gate to Wharf 5)	1	2		-	-	436/d	-	10
E8	Container Trucks Out (Wharf 5 to West gate)	1	2		-	-	436/d	-	10
E9	Thames St Trucks	1	2		-	-	139/d	16/n	10
F	***"Sources F - Shed 4.geo"***								
F1	Pulp Truck (Shed 9 to Shed 4)	1	2		-	-	8/d	32/n	15
F2	Pulp Truck (Shed 7 to Shed 4)	1	2		-	-	29/d	-	15
F3	Pan Pac Trucks In (West gate to Shed 4)	1	2		-	-	25/d	6/n	10
F4	Pan Pac Trucks Out (Shed 4 to West gate)	1	2		-	-	25/d	6/n	10
F5	Diesel Forklifts container packing (4 units)	1	1.5		75% 12h 5d	75% 1h 5n	-	-	-
F6	Diesel Forklift train unloading	1	1.5		75% 5.5h 5d	75% 3.5h 5n	-	-	-
F7	Trucks (Train to Shed 4)	1	2		75% 5.5h 5d	75% 3.5n 5n	-	-	-
F8	Diesel Forklift pulp receival	1	1.5		75% 5.5h 5d	75% 3.5h 5n	-	-	-
F9	Diesel Forklift D1 overflow (2 units)	1	1.5		75% 12h 5d	75% 1h 5n			



MARSHALL DAY Acoustics

Port of Napier Current Port Noise Maps (2020)
Figure 4: Model 5-Day Operational Scenario

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Current 2020 Figure 4 Port Noise Model.SGS, Prepared: cmf, Date: 27 Feb 2020
Napier City Council inputs (2015): Geo referenced topography (1m intervals), cadastral boundaries, building footprints, buildings heights, street numbers and aerial imagery.
Port of Napier inputs (2035): Operational assumptions reviewed and approved 5 Feb 2020

Scale @ A3 1:6000
0 50 100 200 300 m

N

APPENDIX D FUTURE PORT NOISE MAPS (2035)

- Figure 1A Noise Contours 1.5m above ground (5 decibel intervals)
- Figure 1B Noise Contours 1.5m above ground (1 decibel intervals)
- Figure 2A Noise Contours 4m above ground (5 decibel intervals)
- Figure 2B Noise Contours 4m above ground (1 decibel intervals)
- Figure 3A Façade Noise Map (1 decibel intervals 3D perspective)
- Figure 3B Façade Noise Map (5 decibel intervals plan view)
- Figure 3C Façade Noise Map (1 decibel intervals plan view)
- Figure 4 Model 5-day Operational Scenario
- Figure 5 Port Noise Boundaries

MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 1A: Noise contours 1.5m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 1B Noise Contours at 1.5m.SGS, Result file: RRLK0552.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N

Noise level
(dB $L_{dn\ 5\text{-}day}$)

55
56
57
58
59
60
61
62
63
64
65
66
67
68

Breakwater Rd (SH50)
Hardinge Rd
Waghorne St
Ahuriri Bypass (SH50)
Kenny Ave
Battery Rd
Thompson Rd
Cobden Rd
Lighthouse Rd

MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 1B: Noise contours 1.5m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 1B Noise Contours at 1.5m.SGS, Result file: RRLK0552.res, Prepared: cmf, Date: 27 Frb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m

N

MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)

Figure 2A: Noise contours 4m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 2A Noise Contours at 4m.SGS, Result file: RRLK0553.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000

0 25 50 100 150 m

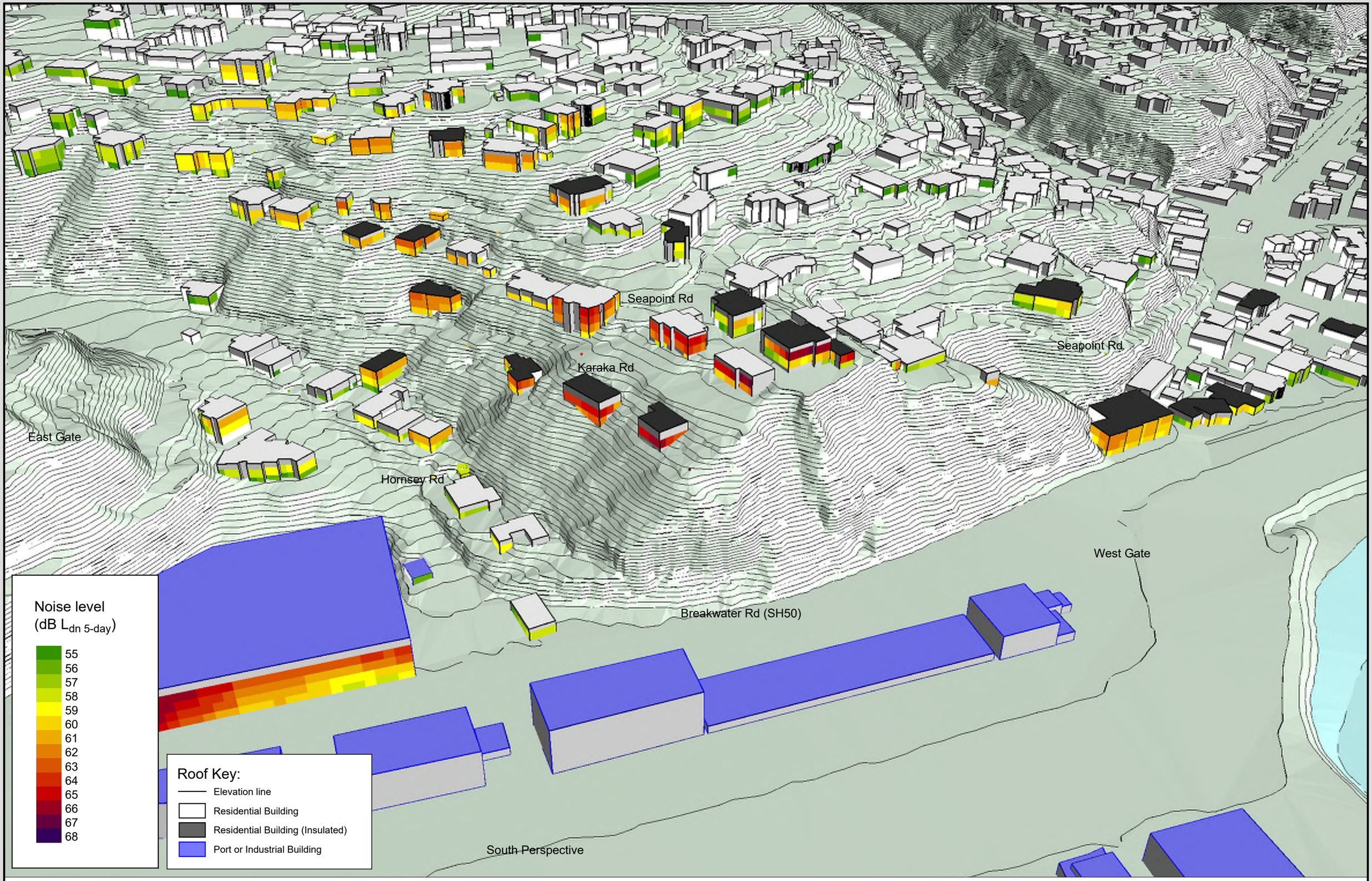
N

MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 2B: Noise contours 4m above ground

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 2B Noise Contours at 4m.SGS, Result file: RRLK0553.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N



MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 3A: Facade Noise Map

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 3A Facade Noise Map.SGS, Result file: RRLK0554.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 3B: Facade Noise Map

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 3B Facade Noise Map.SGS, Result file: RRLK0554.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m
N

Noise level
(dB $L_{dn\ 5\text{-}day}$)

55
56
57
58
59
60
61
62
63
64
65
66
67
68

Buildings:

Property Boundary
Residential Building
Residential Building (Insulated)
Industrial Building

Breakwater Rd (SH50)
Hardinge Rd
Waghorne St
Ahuriri Bypass (SH50)
Kenny Ave
Outram St
Battery Rd
Shakespeare Rd
Seaspray Rd
Thompson Rd
Cobden Rd
Lighthouse Rd
Hornsey Rd

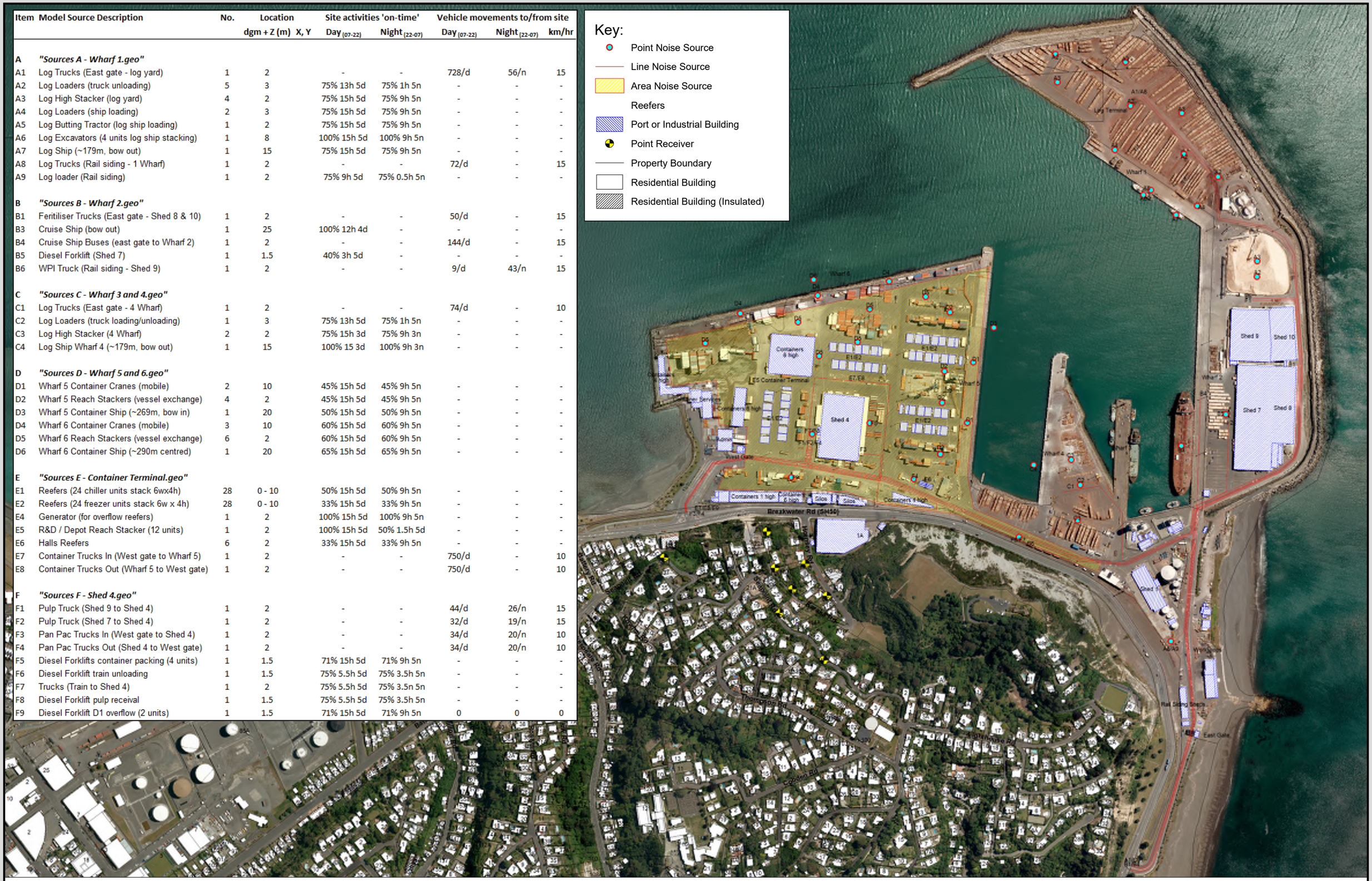
MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 3C: Facade Noise Map

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 3C Facade Noise Map.SGS, Result file: RRLK0554.res, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:4000
0 25 50 100 150 m

Item	Model Source Description	No.	Location dgm + Z (m)	X, Y	Site activities 'on-time' Day (07-22)	Night (22-07)	Vehicle movements to/from site Day (07-22)	Night (22-07)	km/hr
A	***"Sources A - Wharf 1.geo"***								
A1	Log Trucks (East gate - log yard)	1	2		-	-	728/d	56/n	15
A2	Log Loaders (truck unloading)	5	3		75% 13h 5d	75% 1h 5n	-	-	-
A3	Log High Stacker (log yard)	4	2		75% 15h 5d	75% 9h 5n	-	-	-
A4	Log Loaders (ship loading)	2	3		75% 15h 5d	75% 9h 5n	-	-	-
A5	Log Butting Tractor (log ship loading)	1	2		75% 15h 5d	75% 9h 5n	-	-	-
A6	Log Excavators (4 units log ship stacking)	1	8		100% 15h 5d	100% 9h 5n	-	-	-
A7	Log Ship (~179m, bow out)	1	15		75% 15h 5d	75% 9h 5n	-	-	-
A8	Log Trucks (Rail siding - 1 Wharf)	1	2		-	-	72/d	-	15
A9	Log loader (Rail siding)	1	2		75% 9h 5d	75% 0.5h 5n	-	-	-
B	***"Sources B - Wharf 2.geo"***								
B1	Feritiliser Trucks (East gate - Shed 8 & 10)	1	2		-	-	50/d	-	15
B3	Cruise Ship (bow out)	1	25		100% 12h 4d	-	-	-	-
B4	Cruise Ship Buses (east gate to Wharf 2)	1	2		-	-	144/d	-	15
B5	Diesel Forklift (Shed 7)	1	1.5		40% 3h 5d	-	-	-	-
B6	WPI Truck (Rail siding - Shed 9)	1	2		-	-	9/d	43/n	15
C	***"Sources C - Wharf 3 and 4.geo"***								
C1	Log Trucks (East gate - 4 Wharf)	1	2		-	-	74/d	-	10
C2	Log Loaders (truck loading/unloading)	1	3		75% 13h 5d	75% 1h 5n	-	-	-
C3	Log High Stacker (4 Wharf)	2	2		75% 15h 3d	75% 9h 3n	-	-	-
C4	Log Ship Wharf 4 (~179m, bow out)	1	15		100% 15 3d	100% 9h 3n	-	-	-
D	***"Sources D - Wharf 5 and 6.geo"***								
D1	Wharf 5 Container Cranes (mobile)	2	10		45% 15h 5d	45% 9h 5n	-	-	-
D2	Wharf 5 Reach Stackers (vessel exchange)	4	2		45% 15h 5d	45% 9h 5n	-	-	-
D3	Wharf 5 Container Ship (~269m, bow in)	1	20		50% 15h 5d	50% 9h 5n	-	-	-
D4	Wharf 6 Container Cranes (mobile)	3	10		60% 15h 5d	60% 9h 5n	-	-	-
D5	Wharf 6 Reach Stackers (vessel exchange)	6	2		60% 15h 5d	60% 9h 5n	-	-	-
D6	Wharf 6 Container Ship (~290m centred)	1	20		65% 15h 5d	65% 9h 5n	-	-	-
E	***"Sources E - Container Terminal.geo"***								
E1	Reefers (24 chiller units stack 6wx4h)	28	0 - 10		50% 15h 5d	50% 9h 5n	-	-	-
E2	Reefers (24 freezer units stack 6w x 4h)	28	0 - 10		33% 15h 5d	33% 9h 5n	-	-	-
E4	Generator (for overflow reefers)	1	2		100% 15h 5d	100% 9h 5n	-	-	-
E5	R&D / Depot Reach Stacker (12 units)	1	2		100% 15h 5d	50% 1.5h 5d	-	-	-
E6	Halls Reefers	6	2		33% 15h 5d	33% 9h 5n	-	-	-
E7	Container Trucks In (West gate to Wharf 5)	1	2		-	-	750/d	-	10
E8	Container Trucks Out (Wharf 5 to West gate)	1	2		-	-	750/d	-	10
F	***"Sources F - Shed 4.geo"***								
F1	Pulp Truck (Shed 9 to Shed 4)	1	2		-	-	44/d	26/n	15
F2	Pulp Truck (Shed 7 to Shed 4)	1	2		-	-	32/d	19/n	15
F3	Pan Pac Trucks In (West gate to Shed 4)	1	2		-	-	34/d	20/n	10
F4	Pan Pac Trucks Out (Shed 4 to West gate)	1	2		-	-	34/d	20/n	10
F5	Diesel Forklifts container packing (4 units)	1	1.5		71% 15h 5d	71% 9h 5n	-	-	-
F6	Diesel Forklift train unloading	1	1.5		75% 5.5h 5d	75% 3.5h 5n	-	-	-
F7	Trucks (Train to Shed 4)	1	2		75% 5.5h 5d	75% 3.5n 5n	-	-	-
F8	Diesel Forklift pulp receival	1	1.5		75% 5.5h 5d	75% 3.5h 5n	-	-	-
F9	Diesel Forklift D1 overflow (2 units)	1	1.5		71% 15h 5d	71% 9h 5n	0	0	0



MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 4: Model 5-Day Operational Scenario

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 4 Port Noise Model.SGS, Prepared: cmf, Date: 27 Feb 2020
Napier City Council inputs (2015): Geo referenced topography (1m intervals), cadastal boundaries, building footprints, buildings heights, street numbers and aerial imagery.
Port of Napier inputs (2035): Operational assumptions reviewed and approved 5 Feb 2020

Scale @ A3 1:6000
0 50 100 200 300 m

N

Port Noise Boundaries

- Operative Inner Boundary
- Operative Outer Boundary
- Model 2035 Inner Boundary
- Model 2035 Outer Boundary

MARSHALL DAY Acoustics

Port of Napier Future Port Noise Maps (2035)
Figure 5: Port Noise Boundaries

Client: Port of Napier Ltd
Path: I:\JOBS\2019\20190436\04 Calculations\Sp001 Port Napier 2020
Filename: 2020 Future 2035 Figure 5 Port Noise Boundaries.SGS, Prepared: cmf, Date: 27 Feb 2020
The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of +/- 1.5dB. For precise noise levels at specific location, refer to point receiver calculations.

Scale @ A3 1:5000

0 35 70 140 210 m

N