MARSHALL DAY Acoustics

PORT OTAGO

PORT NOISE MAPS 2022

Rp 002 20210952 | 6 December 2022

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Project: **PORT NOISE MAPS 2022**

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Document Control

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TABLE OF CONTENTS

1.0 SUMMARY

Marshall Day Acoustics Limited (**MDA**) first prepared a noise model for Port Otago in 1994. The noise model has regularly been reviewed to establish the Dunedin City Council (**DCC**) Port Noise Control Boundaries, evaluate future development options, Second Generation Plan (**2GP**) and reflect changes in current operations.

Port Otago has engaged MDA to review the Current Port Noise Maps. These are prepared to represent the noise environment for the representative peak 5-day operating period. Noise monitoring data from the previous year (2021-2022) is used to verify and calibrate the noise model. The updated noise maps will be included in a revision of the Port Noise Management Plan.

The noise model has been updated for the 2022 scenario. There have been no material changes to Port Otago operations in 2022. However, the updated noise model includes changes to buildings on the Port and nearby sites.

Silencers have now been fitted to the Rio vessels, which significantly reduces the low frequency noise and removes the 'rumble' effect. However, there are still periods where "unsilenced" generators are required to operate in extenuating circumstances.

The following report provides a summary of the performance standards and modelling methodology. The Current Port Noise Maps 2022 in Section 4.0 and Appendix C represent the current peak operations period, including a Rio Class vessel visiting the Multi Purpose Wharf with an unsilenced generator operating. This ensures a conservative representation of the noise contours in the coming year.

Note that a glossary of technical terms is included in Appendix A.

2.0 PERFORMANCE STANDARDS

2.1 Port Noise Standard (NZS 6809: 1999)

Noise from Port Otago is experienced primarily on the landward side of the mean high-water springs and is managed in accordance with the Dunedin City District Plan. The District Plan provisions have been influenced by New Zealand's Port Noise Standard NZS 6809.

The objective of NZS 6809 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 the adjacent residential communities can co-exist with ports and their associated activities.

The Standard uses the concept of *Inner* and *Outer 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. Furthermore, port companies and port users should implement management plans to manage and monitor noise from their operations, with the aim of progressively reducing noise levels wherever practicable.

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. For NZS 6809, the *Inner* and *Outer Control Boundaries* equate to a predicted noise level over a 5-day period of 65 dB L_{dn} and 55 dB L_{dn} respectively.

The control boundaries are derived from the noise contours for the predicted peak operations period in the lifetime of the District Plan, which is typically 10 years in the future. The control boundaries are inclusive, following cadastral boundaries.

2.2 Proposed Second Generation District Plan

The Proposed Second Generation District Plan (2GP) is currently in an appeals version. However, all appeals relating to noise from the port have been resolved. Therefore, the 2GP is effectively operative for noise related matters. As such, sections of the previous version of the DCC District Plan (2006) relating to noise from the Port no longer apply.

Port Otago activities are subject to rule 30.5.4, included in Appendix B. A 'Port Noise Control Area' overlay is used to indicate the outer control boundary. This control boundary is included in Appendix C.

2.3 Port Noise Management

NZS 6809:1999 provides guidance on the development and application of a Noise Management Plan. This is 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*".

The Port Otago Noise Management Plan[1] was updated in early 2020 in-line with best practice. It is available on the Port Otago website here: https://www.portotago.co.nz/about/sustainability/.

2.4 Port Noise Mitigation

Port Otago has upgraded the acoustic performance of a significant number of dwellings over the last decade. Guidance on the mitigation scheme can also be found on the Port Otago website here: https://www.portotago.co.nz/about/sustainability/.

[1] MDA report Rp 001 20190116, dated 13 March 2020

3.0 MODELLING METHODOLOGY

3.1 Overview

A computer-based noise model is used to predict the 'energy average' noise emissions from the Port over a peak five-day operating period. The model consists of the following parts that must be accurate for the noise contours to be reliable:

- **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.
- **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.

3.2 Noise Sources

The noise source data for the model was prepared from measurements carried out of Port of Otago machinery. In some cases, equipment information was supplemented with representative data measured at other Ports (e.g. ships) in order to make it more complete.

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 1 summarises the sources used in the noise model.

Table 1: Noise sources used in the operational noise models

Noise Sources used in Model[1]	Sound Power Level (dB L_{wA})
Cranes, trains	110 – 120
Normal Ships (e.g. log, container, cruise)	105 – 115
Rio Class container ship – without silencer[2]	**115 – 120**
Straddle carriers, log loaders and trucks	100 – 110
Small fork-lifts	90 – 100
Reefer units	85 – 90

[1] Vehicles on public roads are excluded from port noise contours
[2] Vessels sometimes need to operate "unsilenced" generators (see Section 3.3)

3.3 Rio Class ships still sometimes operate "unsilenced" generators

Reactive silencers have now been installed on most of the Rio Class container ships. The reactive silencers have removed the low frequency 'rumble' that has caused noise complaints from the community.

These vessels started visiting Port Chalmers on a regular basis in late 2018, which resulted in community noise complaints, primarily due to the low frequency character (i.e. 'rumble') produced by the onboard generators.

Port noise is typically broadband in character; however, the Rio Class ships produced disproportionally high levels of low frequency sound energy compared with a normal container ship or other typical port activities. Noise complaints are primarily received at night when people are inside, presumably with the windows shut. Due to the low frequency nature of the noise, Rio Class ships were perceived as significantly louder than other typical container ships.

Port Otago engaged with Maersk to address the low frequency noise effects. Maersk undertook further measurements and assessments using their own acoustic experts. As a result, each vessel has been fitted with a silencer which has reduced the overall noise level and low frequency component, bringing residual noise levels in line with other typical ships.

The silencers have been installed on one of the two main generators on each ship. Typically, the generator with the silencer installed will be used while in port. However, there continue to be instances where the "unsilenced" generator is used while in port. This is often due to generator load requirements (i.e. more than one generator is required) or an engineering fault with the silenced generator.

3.4 Operational Scenario

The Current Port Noise Maps are produced from the 'busy 5-day' operational scenario model, which is updated annually. The Port operational input assumptions are essential to ensure the model reflects the peak 5-day period of maximum cargo throughput or activity.

The modelling assumptions include a description, the number of, and an equivalent 'on-time' description for each noise source. The 'on-time' operational profile is explained by way of the following four examples, shown in Figure 3 of the Current Port Noise Maps (2022) included in Appendix C:

- Item A2: 'Ship (Standard Container Vessel)'
  This represents a normal container ship on the Container Terminal Wharf. The sound power level of each unit is included at a representative location identified in Figure 3. The daytime 'on-time' summary description '100% 9h 2d' indicates that a vessel fitting this description is typically operating/idling 100% of an activity period spanning 9 hours on 2 days (0700 – 2200) during the 5-day modelling period. There is one of these sources included in the model, as denoted in the 'No.' column.

- Item A6: 'Straddle Carriers – B Block (6 off)'
  This represents six straddle carriers operating in the B Block container yard. The cumulative sound power level is for six units evenly distributed over its region of operation shown in Figure 3.

- Item B4: 'Ship (Rio Vessel) "unsilenced" generator'
  This represents the Rio Class vessel bow out on the Multi Purpose wharf spanning a period of one night and two days. The noise source used in the model is the measured noise source level without a reactive silencer fitted. This represents a situation where a Rio Class vessel is required to operate an "unsilenced" generator for the duration of its visit (see Section 3.3).

- Item D5: 'Log trucks'
  This represents truck movements between the Beach Street gate and the log yard, 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 3 at an average speed of 15km/h. The number of movements is input as 100 truck movements per day for 3 days and none at night over the 5-day peak period.

3.5 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.

The SoundPLAN model 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 DCC (March 2016):

- Topographical contours at 1m intervals
- Cadastral and port noise control boundaries
- Building heights
- Street numbers and names

Port Otago provided high resolution imagery of port operations (2018) and stitched this into publicly available geo referenced aerial imagery (2013). MDA created building footprints by tracing the building outline shown on the geo referenced aerial imagery. DCC attached the building height attribute to the building footprints supplied by MDA. This has been updated in 2022 to account for the removal and addition of buildings on the Port and surrounding area.

The noise contours are obtained by computer interpolation between calculated grid points at 10m intervals. The façade noise maps are calculated grid points at 3m intervals, starting at 1.5m above ground level.

3.6 Calibration

Four permanent noise monitoring stations are located on the hills overlooking the Port. The monitors are referred to as:

- Scotia St (near 19 Scotia Street)
- Cemetery (in the cemetery - previously referred to as the Careys Bay monitor)
- Henry St (near 3 Henry St, Careys Bay)
- Light Tower 4 (on the western side of the Multi Purpose Wharf)

The noise environment at the Scotia St and Cemetery monitors are controlled by port noise, and therefore, reliably calibrate the noise model. The monitors at Light Tower 4 and Henry Street are used primarily to identify high noise events for noise management purposes.

The noise monitors record summary noise statistics every 15 minutes, 24 hours a day, 365 days per year. From this, the rolling 5-day L_{dn} noise level is calculated and compared to the predicted contours at the two reference points at Scotia St and the Cemetery.

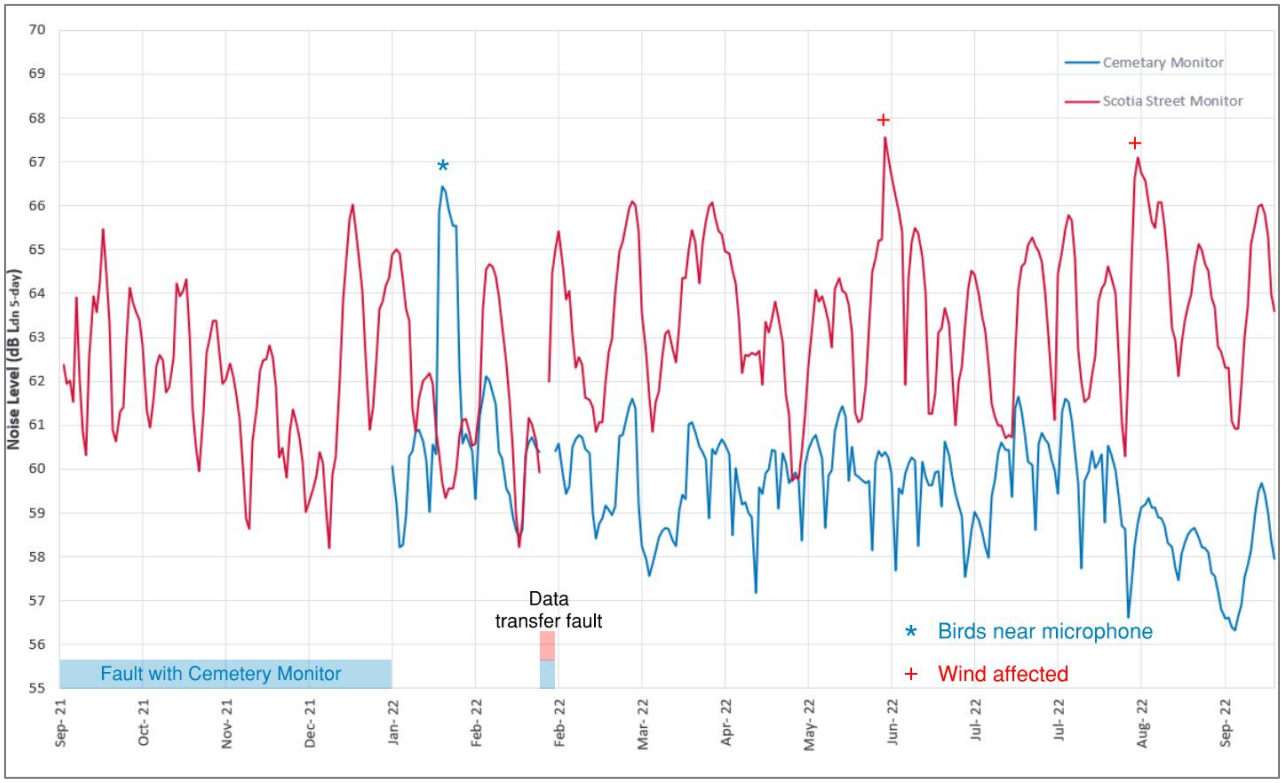
3.7 Noise monitoring results

Noise monitoring summary results between 2012 and 2022 for the Scotia St and Cemetery monitors are summarised in Table 1. An annotated time trace for the year October 2021 to September 2022 is included in Figure 1.

Table 2: Annual Noise Monitoring Results

Year	Scotia St Monitor (dB $L_{dn\ 5\ day}$)		Cemetery Monitor (dB $L_{dn\ 5\ day}$)	
	Median Period	Peak Period	Median Period	Peak Period
2012	64	68	61	65
2013	62	66	61	65
2014	61	68	61	64
2015	62	67	60	63
2016	62	68	60	64
2017	63	66	61	63
2018	63	68	61	63
2019	63	69	62	65
2020	63	69	62	65
2021	62	67[2]	61	65[2]
2022[3]	63	66[2]	60	62[2]

Figure 1: Monitoring Results



[2] Periods of wind induced noise or birds near the monitor have been excluded

[3] Part year to 30 Sep 2022

The monitoring trends can be summarised as follows:

- Both the median and peak periods have remained relatively stable since 2012, although peaked in 2019 due to Rio class ships prior to silencer upgrades
- The peak 5-day period is typically 2-4 decibels louder than the median 5-day period at each monitor
- The noise level received at the Scotia St monitor is typically 2-4 decibels louder than at the Cemetery monitor

The 2022 noise model predicted 67 dB $L_{dn\ 5\ day}$ at the Scotia Street monitor and 67 dB $L_{dn\ 5\ day}$ at the Cemetery monitor. Results from the monitors and attended noise surveys in 2012 and 2018 were used to verify the shape of the modelled noise contours at multiple locations. At that time, the agreement between predicted and measured contours was generally good (± 2 decibels). Note that ± 2 decibels accuracy is normal and is considered acceptable for environmental noise predictions.

During the previous year (Oct 2021 – Sept 2022) the noise level for the peak 5 day period at Cemetery monitor is 5 dB below the predicted peak period in the noise model. Whilst previously within modelling tolerance, the model was known to be slightly conservative at this location. However, it is particularly noticeable from this years' monitoring data that the noise model is outside acceptable tolerance (i.e. too conservative). This may be due to reduced throughput as a result of covid and a reduced effect of Rios due to the installation of silencers.

If this trend continues, we would recommend a more detailed review of the model inputs and attended monitoring programme to reverify the level and shape of the noise contours. Such an exercise is usually undertaken every 5-10 years.

To get best value from the detailed model review and verification process, we recommend that it is undertaken following the construction of the new port services building and removal of the old buildings in late 2023.

4.0 CURRENT PORT NOISE MAPS

The Current Port Noise Maps are included in Appendix C. The Figures are summarised as follows:

- Figures 1B, 1C: 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 21.5.2).
- Figures 2A and 2B: The 3D façade noise map predicts noise levels received at the façades of dwellings. The plan view façade noise maps display the highest noise level received on the façades. This is useful for considering the noise mitigation requirements of Appendix 30B of the 2GP.
- Figure 3: Presents the modelling inputs and assumptions.

As detailed above, the monitoring of noise from Oct 2021 – Sept 2022 indicates that the noise model remains representative near Scotia St (south), but is conservatively over predicting noise levels at the Cemetery monitor (north-west).

APPENDIX A GLOSSARY OF TERMINOLOGY

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.
$L_{A90\,(t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
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}.
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.

APPENDIX B SECOND GENERATION DISTRICT PLAN, CHAPTER 30 – PORT

Rule 30.5 Land Use Performance Standards

30.5.4 Port Noise Management

1. For all port activity, the Port Operator at Port Chalmers must:
    a) develop a noise management and noise mitigation plan for Port Chalmers to provide for noise minimisation, mitigation of the effects of port noise and community liaison;
    b) investigate and adopt the best practicable option to minimise port noise emissions, including specific measures to reduce the occurrence of loud, single noise events (including those associated with handling containers and logs);
    c) produce and, at all times, operate in accordance with a port noise management plan, which must include, but is not limited to, the matters set out in **Appendix 30A**;
    d) implement and annually update a port noise mitigation plan for the purchase or acoustic treatment of noise affected properties, which must include, but is not limited to, the matters set out in **Appendix 30B**; and
    e) establish, maintain and participate in a port noise liaison committee, which must operate in accordance with the requirements set out in **Appendix 30C**.
2. Port activity that contravenes the performance standard for Port Noise Management is a non-complying activity.

Appendix 30

The following must be observed in relation to any measurements or assessments of port noise required by these Appendices:

1. Unless stated otherwise, port noise must be measured in accordance with NZS 6801:2008 Acoustics – Measurement of Environmental Sound and assessed in accordance with NZS 6809:1999 Acoustics – Port Noise Management and Land Use Planning, provided that:
    a) subject to Rule 9.3.6.7.a, the rating level described in clause 7.3 of NZS 6809:1999 Acoustics - Port Noise Management and Land Use Planning must be determined for the sole purpose of defining any L_{eq} (15 min) sound level, required for the purposes of **Appendices 30A** and **30B;** and
    b) adjustments for any special audible characteristics to any L_{eq} (15 min) made in accordance with clause 7.3 and A6 of NZS 6809:1999 exclude audible warning devices.
2. For the purpose of comparison with noise criteria specified in **Appendix 30B** the following apply:
    a) in calculating any L_{dn} (5 day average), one ship visit of up to five days duration will be deemed to be one occasion; and
    b) in assessing any L_{eq} (15 min) sound level between 10pm and 7am the following day, one ship visit of up to five days duration will be deemed to be one occasion.

Appendix 30A. Port Noise Management Plan

30A.1 Minimum port noise management plan provisions

The Port Noise Management Plan required by **Rule 30.5.4** must contain the following:

1. Port Noise Management Plan objectives;
2. detailed procedures for the implementation of **Rule 30.5.4**, including the Port Noise Mitigation Plan outlined in **Appendix 30B** and the establishment and maintenance of a Port Noise Liaison Committee outlined in **Appendix 30C**;

3. a list of Port Noise Liaison Committee functions;
4. procedures for recommendations of the Port Noise Liaison Committee to be considered and determined by the Port Operator;
5. noise modelling, noise monitoring, auditing and reporting procedures;
6. complaint handling procedures;
7. procedures for achieving noise reduction through port operational procedures and staff and contractor training; and
8. procedures for alterations to, and the annual update of, the Port Noise Management Plan.

30A.2 Minimum monitoring and reporting requirements

1. The Port Operator must maintain, at its expense, sound level monitoring equipment to ensure the continuous measurement of port noise emanating from port related activities 24 hours a day and seven days a week, including at least one monitor in a location representative of the Careys Bay residential community. All community noise monitors must record calibrated audio of noise events measured above 75 dB L_{AFmax} between 10pm and 7am.
2. The Port Operator must provide the results of sound level monitoring to Council and the Port Noise Liaison Committee in a summary form showing L_{eq}, calculated Ldn sound exposure and L_{max} levels not less than four times a year. This monitoring must highlight significant port noise emissions and correlate these with port activity (using port CCTV imagery and equipment loqs) and wind speed and wind direction data.
3. When sound level monitoring indicates that port noise may be exceeding 65 dBA L_{dn} (5 day average) or 65 dBA L_{eq} (15 min, 10pm - 7am) at noise affected properties that are not shown on the Port Noise Contour Map as eligible for mitigation under **Appendix 30B.1**, the exceedance must be recorded, investigated and reported to the Port Noise Liaison Committee. The investigation must identify as far as possible those noise affected properties receiving port noise at or above such levels.
4. The Port Operator must produce and include in the Port Noise Management Plan a port noise contour map based on a current busy 5 day operating scenario. The contour map must be updated at least on an annual basis or when a change to port operations is likely to affect the levels of port noise received in surrounding parts of the Township and Settlement, Rural Residential 2, Recreation, Industrial, Port Chalmers Principal Centre or the Hill Slopes Rural zones. Port noise contours must be modelled at 1dB intervals between 55 L_{dn} and 70 L_{dn}.
5. To ensure the accuracy of the Port Noise Contour Map, the Port Operator must perform field verification of calculated sound exposure levels and assessed L_{eq} (15 min) levels of port noise at the agreed monitoring points identified in the Port Noise Management Plan.
6. Those noise affected properties confirmed as eligible for mitigation under **Appendix 30B.1** must be identified on the Port Noise Contour Map.
7. The Port Operator must maintain an acoustic certificate register. A copy of the register and acoustic certificates for noise affected properties must be supplied to Council. Copies of the register and acoustic certificates must also be held at the offices of the Port Operator and the Dunedin City Council and made available to members of the public on request.
8. The Port Operator must make available to the Port Noise Liaison Committee or Council on request all information the Port Operator has as to noise and meteorological conditions.
9. When a noise complaint is received, the Port Operator will immediately advise the Dunedin City Council (if the complaint is not received through the Dunedin City Council).

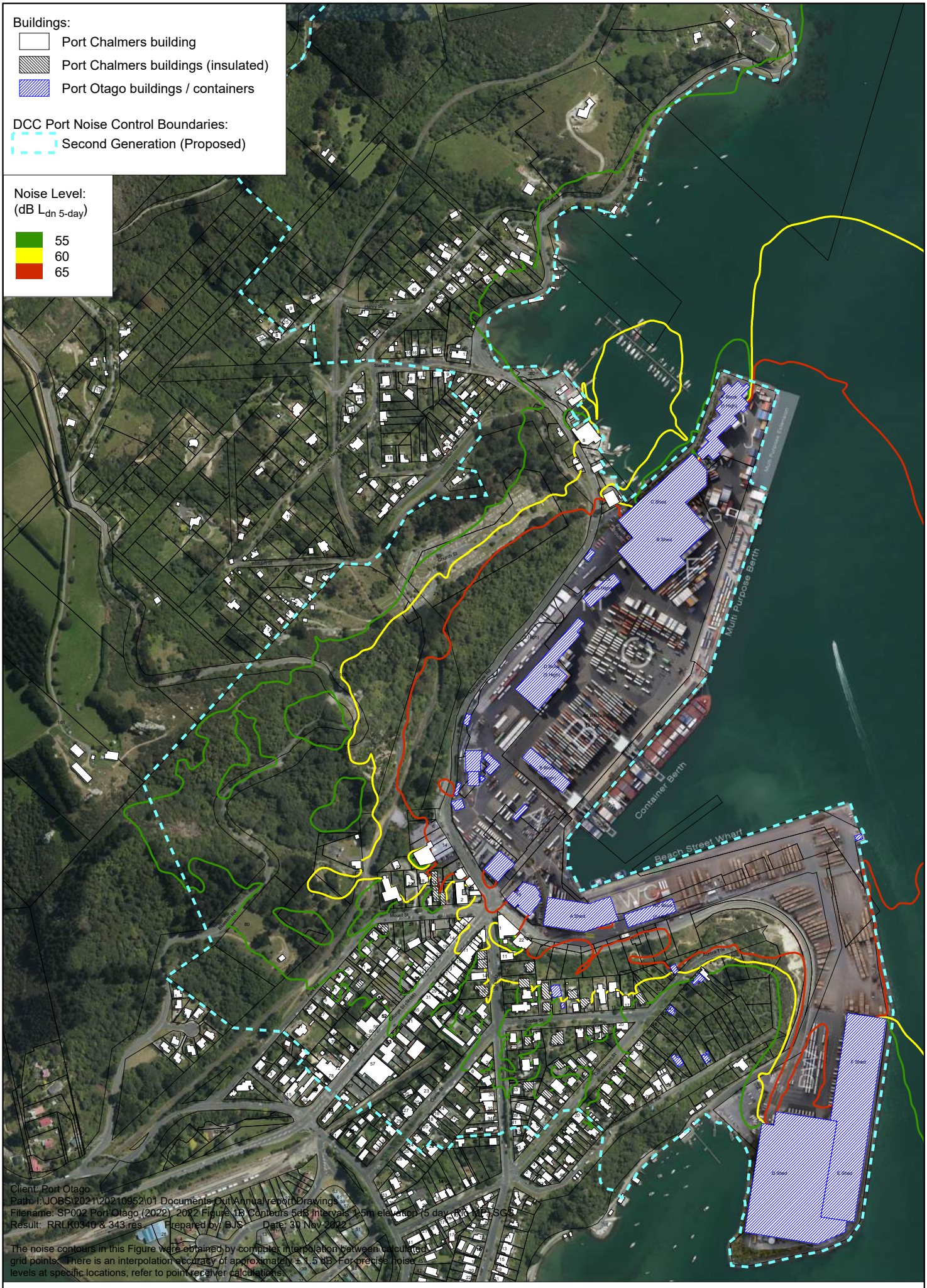
10. The Port Operator must maintain a register of noise complaints and report the details of complaints and any action taken to investigate and resolve complaints to the Port Noise Liaison Committee at the earliest opportunity.
11. Copies of the Port Noise Management Plan are to be held at the offices of the Port Operator and the Dunedin City Council and on their respective websites, and made available to members of the public on request.

Appendix 30B. Port Noise Mitigation Plan (not reproduced in full here)

Appendix 30C. Port Noise Liaison Committee (not reproduced in full here)

APPENDIX C CURRENT PORT NOISE MAPS

- Figure 1B Peak Operations Period (1.5m elevation, 5 decibel intervals)
- Figure 1C Peak Operations Period (1.5m elevation, 1 decibel intervals)
- Figure 2A Façade Noise Map (plan view, 5 decibel intervals)
- Figure 2B Façade Noise Map (3D perspective, 1 decibel intervals)
- Figure 3 Model 5-day Operational Scenario



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Path: I:\JOBS\2021\20210952\01 Documents Out\Annual report\Drawings
Filename: SP002 Port Otago (2022) 2022 Figure 1B Contours 5dB Intervals 1.5m elevation (5 day) (GIS).SGS
Result: RRLK0340 & 343.res Prepared by: BJS Date: 30 Nov 2022

The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of approximately ± 1.5 dB. For precise noise levels at specific locations, refer to point receiver calculations.

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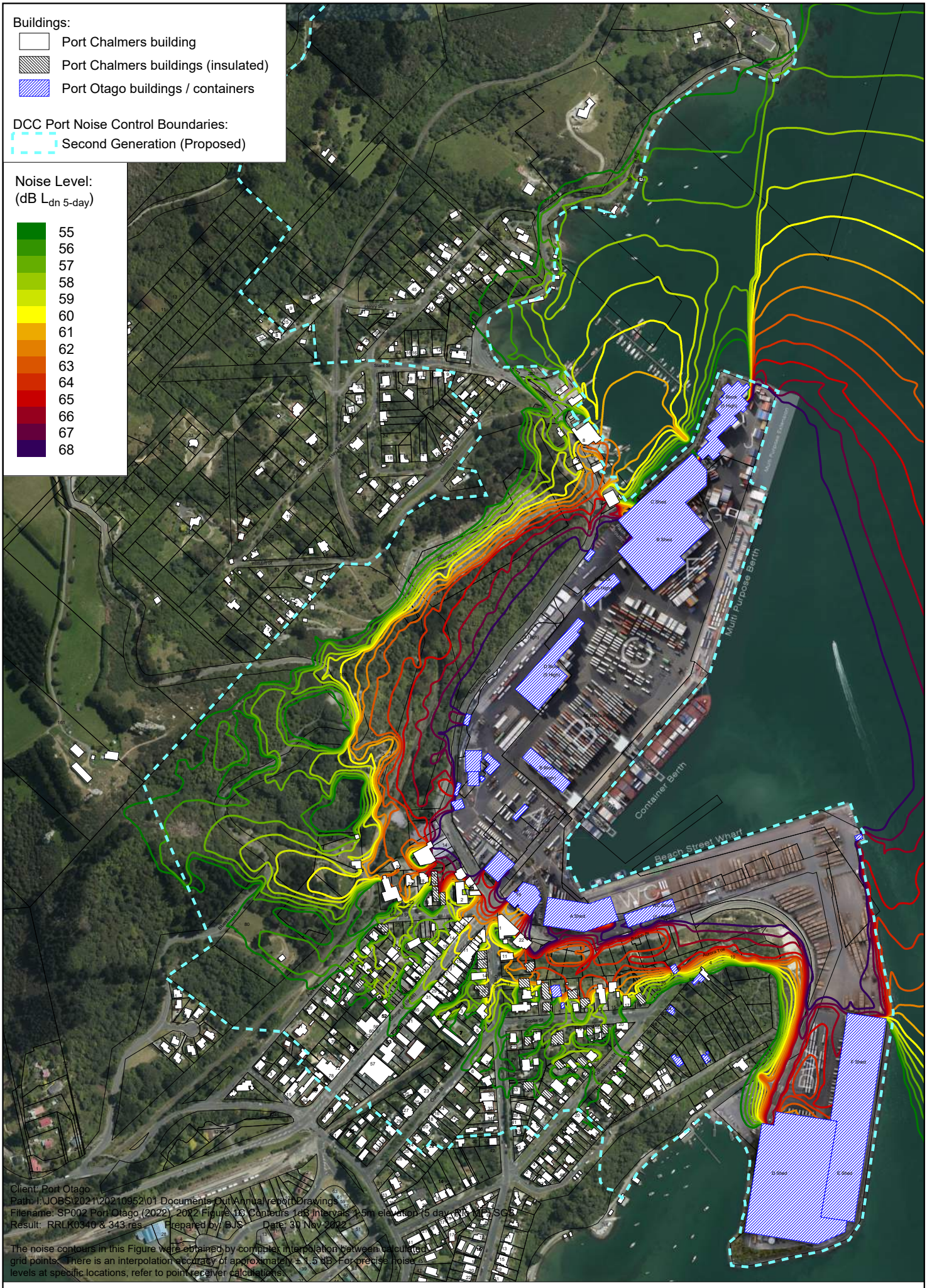
Port Otago - Current Port Noise Maps (2022)
Figure 1B: Peak Period (1.5m elevation)

Scale @ A3 1:5000

0 25 50 100 150 200 m

N



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Filename: SP002 Port Otago (2022) 2022 Figure 1C Contours 1dB Intervals 1.5m elevation (5 day).wor / .SGS
Result: RRLK0340 & 343.res Prepared by: BJS Date: 30 Nov 2022

The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of approximately ± 1.5 dB. For precise noise levels at specific locations, refer to point receiver calculations.

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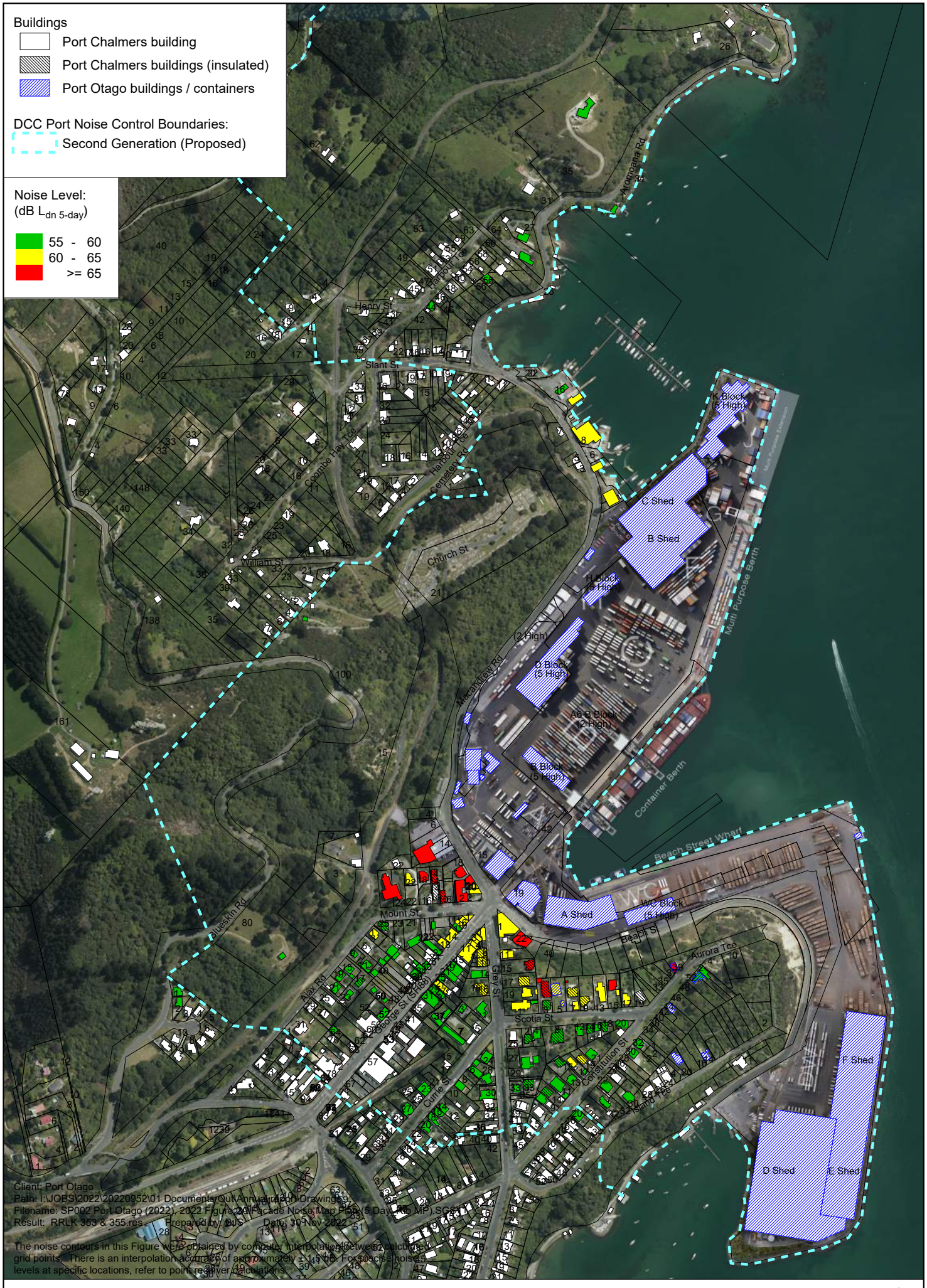
Port Otago - Current Port Noise Maps (2022)
Figure 1C: Peak Period (1.5m elevation)

Scale @ A3 1:5000

0 25 50 100 150 200 m

N



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Path: I:\JOBS\2022\20220952\01 Documents\Out\Annual Report Drawings\
Filename: SP002 Port Otago (2022) 2022 Figure 2A Facade Noise Map P55 (5 Day) (No MP).SGS
Result: RRLK 363 & 355.res Prepared by: BJS Date: 30 Nov 2022

The noise contours in this Figure were obtained by computer interpolation between calculated grid points. There is an interpolation accuracy of approximately ± 1 to 2 dB. For precise noise levels at specific locations, refer to point receiver calculations.

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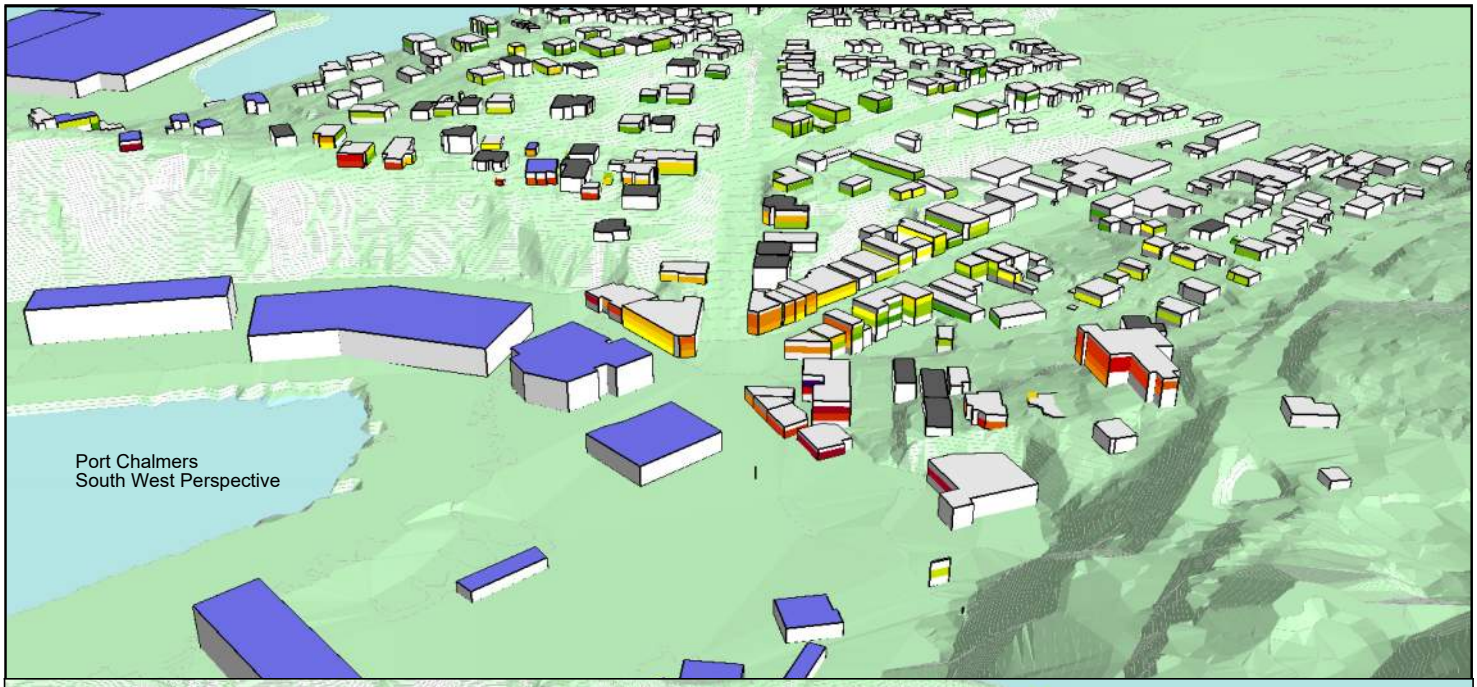
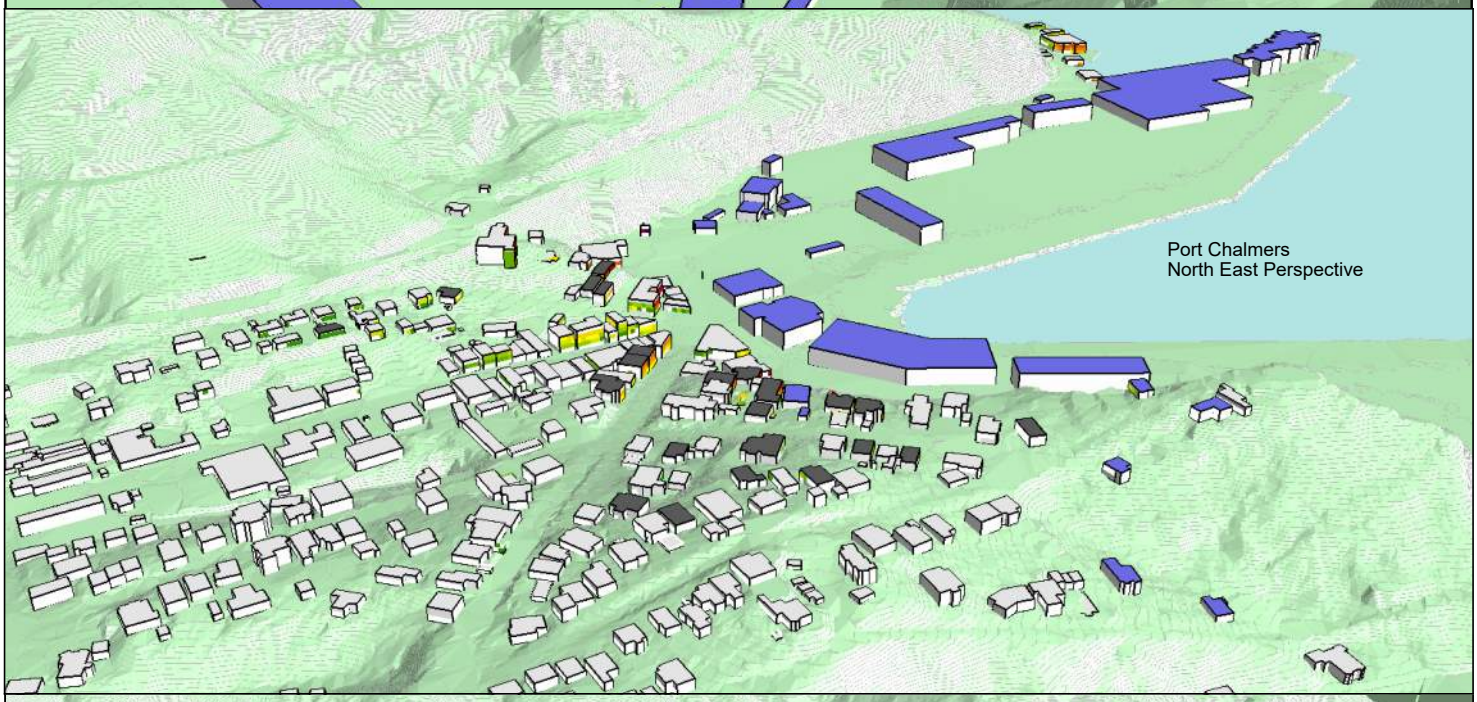
Port Otago - Current Port Noise Maps (2022)
Figure 2A: Facade Noise Map pre mitigation

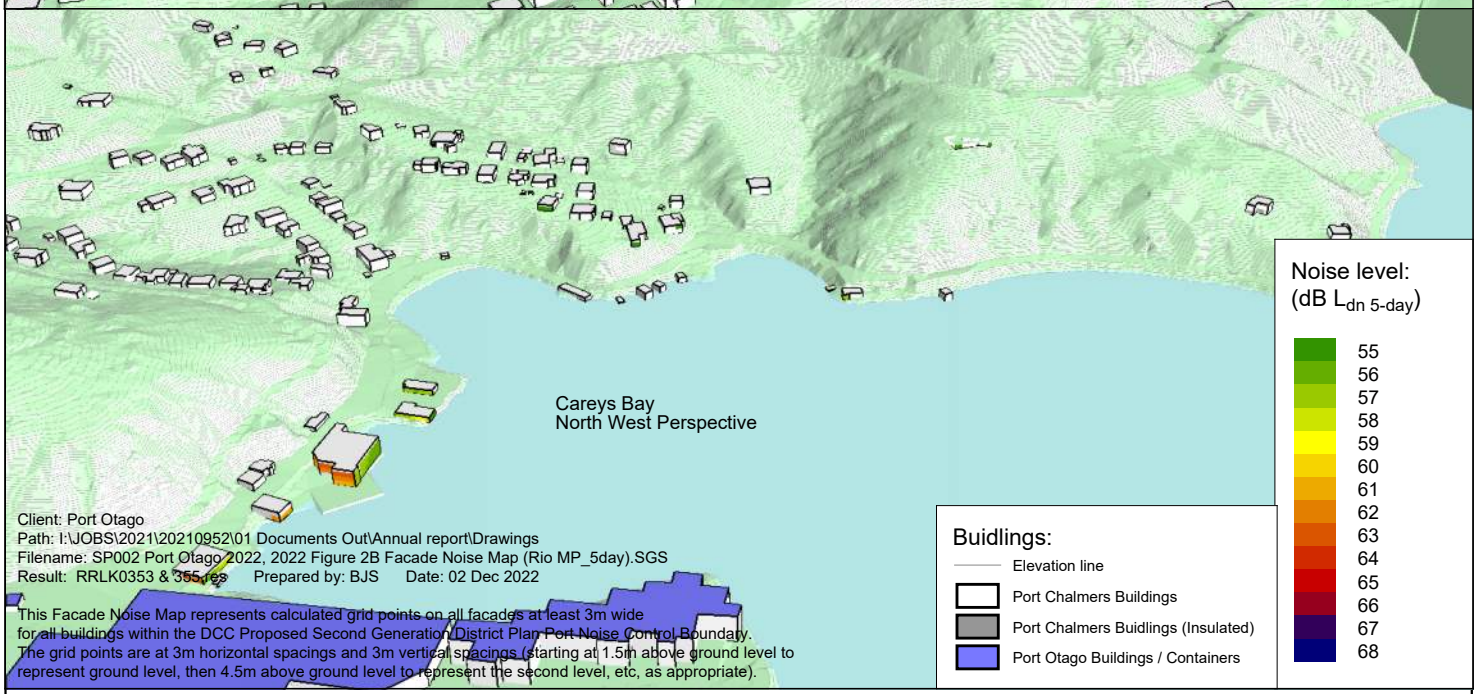
Scale @ A3 1:5000

0 25 50 100 150 200 m

N







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

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

Buidlings:

Elevation line
Port Chalmers Buildings
Port Chalmers Buidlings (Insulated)
Port Otago Buildings / Containers

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Filename: SP002 Port Otago 2022, 2022 Figure 2B Facade Noise Map (Rio MP_5day).SGS
Result: RRLK0353 & 355.res Prepared by: BJS Date: 02 Dec 2022

This Facade Noise Map represents calculated grid points on all facades at least 3m wide for all buildings within the DCC Proposed Second Generation District Plan Port Noise Control Boundary. The grid points are at 3m horizontal spacings and 3m vertical spacings (starting at 1.5m above ground level to represent ground level, then 4.5m above ground level to represent the second level, etc, as appropriate).

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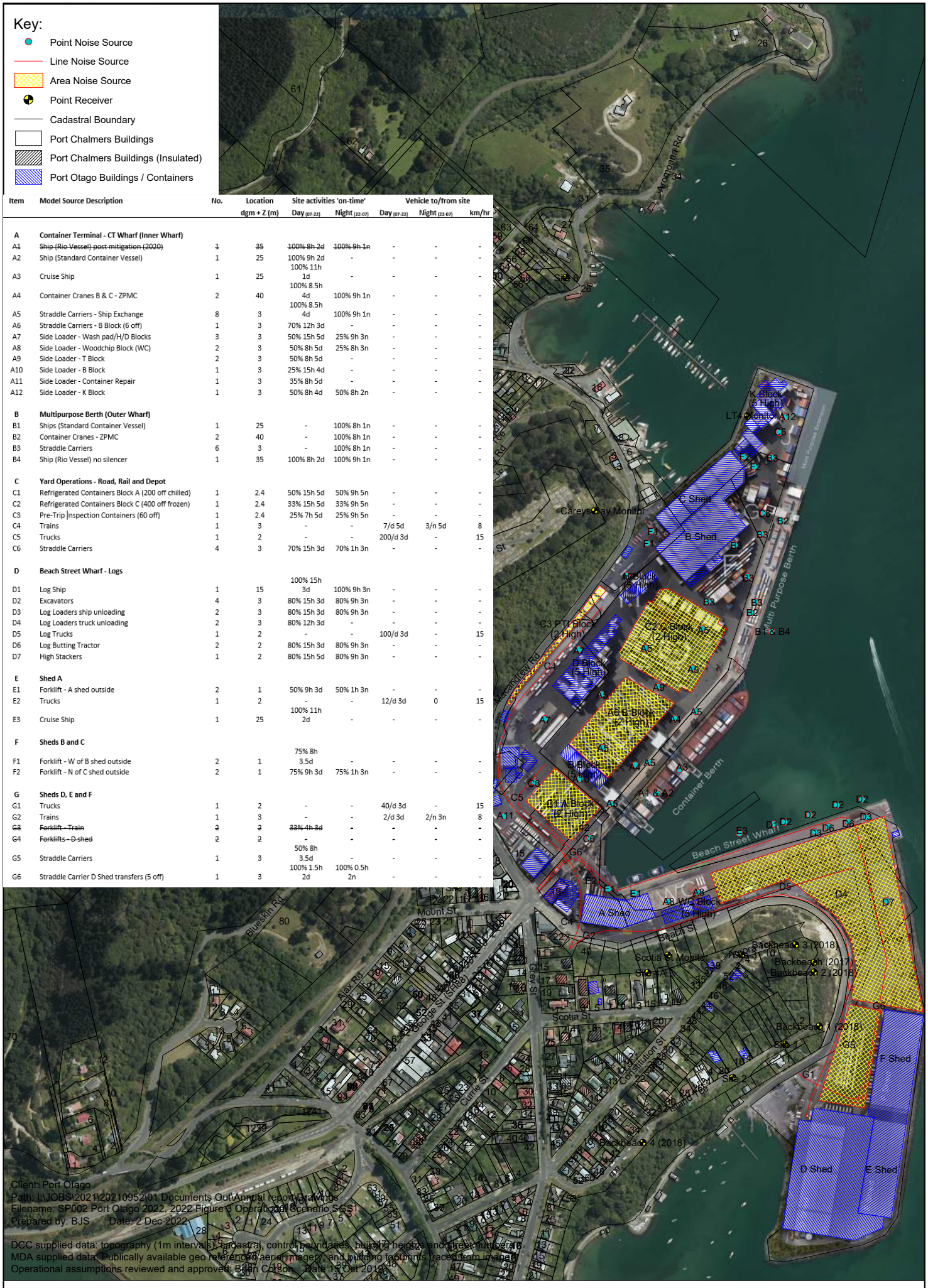
Port Otago - Current Port Noise Maps (2022)
Figure 2B: Facade Noise Map



Item	Model Source Description	No.	Location dgm + Z (m)	Site activities 'on-time' Day (07-22)	Site activities 'on-time' Night (22-07)	Vehicle to/from site Day (07-22)	Vehicle to/from site Night (22-07)	Vehicle to/from site km/hr
A	**Container Terminal - CT Wharf (Inner Wharf)**							
~~A1~~	~~Ship (Rio Vessel) post mitigation (2020)~~	~~1~~	~~35~~	~~100% 8h 2d~~	~~100% 9h 1n~~	-	-	-
A2	Ship (Standard Container Vessel)	1	25	100% 9h 2d	-	-	-	-
A3	Cruise Ship	1	25	100% 11h 1d	-	-	-	-
A4	Container Cranes B & C - ZPMC	2	40	100% 8.5h 4d	100% 9h 1n	-	-	-
A5	Straddle Carriers - Ship Exchange	8	3	100% 8.5h 4d	100% 9h 1n	-	-	-
A6	Straddle Carriers - B Block (6 off)	1	3	70% 12h 3d	-	-	-	-
A7	Side Loader - Wash pad/H/D Blocks	3	3	50% 15h 5d	25% 9h 3n	-	-	-
A8	Side Loader - Woodchip Block (WC)	2	3	50% 8h 5d	25% 8h 3n	-	-	-
A9	Side Loader - T Block	2	3	50% 8h 5d	-	-	-	-
A10	Side Loader - B Block	1	3	25% 15h 4d	-	-	-	-
A11	Side Loader - Container Repair	1	3	35% 8h 5d	-	-	-	-
A12	Side Loader - K Block	1	3	50% 8h 4d	50% 8h 2n	-	-	-
B	**Multipurpose Berth (Outer Wharf)**							
B1	Ships (Standard Container Vessel)	1	25	-	100% 8h 1n	-	-	-
B2	Container Cranes - ZPMC	2	40	-	100% 8h 1n	-	-	-
B3	Straddle Carriers	6	3	-	100% 8h 1n	-	-	-
B4	Ship (Rio Vessel) no silencer	1	35	100% 8h 2d	100% 9h 1n	-	-	-
C	**Yard Operations - Road, Rail and Depot**							
C1	Refrigerated Containers Block A (200 off chilled)	1	2.4	50% 15h 5d	50% 9h 5n	-	-	-
C2	Refrigerated Containers Block C (400 off frozen)	1	2.4	33% 15h 5d	33% 9h 5n	-	-	-
C3	Pre-Trip Inspection Containers (60 off)	1	2.4	25% 7h 5d	25% 9h 5n	-	-	-
C4	Trains	1	3	-	-	7/d 5d	3/n 5d	8
C5	Trucks	1	2	-	-	200/d 3d	-	15
C6	Straddle Carriers	4	3	70% 15h 3d	70% 1h 3n	-	-	-
D	**Beach Street Wharf - Logs**							
D1	Log Ship	1	15	100% 15h 3d	100% 9h 3n	-	-	-
D2	Excavators	4	3	80% 15h 3d	80% 9h 3n	-	-	-
D3	Log Loaders ship unloading	2	3	80% 15h 3d	80% 9h 3n	-	-	-
D4	Log Loaders truck unloading	2	3	80% 12h 3d	-	-	-	-
D5	Log Trucks	1	2	-	-	100/d 3d	-	15
D6	Log Butting Tractor	2	2	80% 15h 3d	80% 9h 3n	-	-	-
D7	High Stackers	1	2	80% 15h 5d	80% 9h 3n	-	-	-
E	**Shed A**							
E1	Forklift - A shed outside	2	1	50% 9h 3d	50% 1h 3n	-	-	-
E2	Trucks	1	2	-	-	12/d 3d	0	15
E3	Cruise Ship	1	25	100% 11h 2d	-	-	-	-
F	**Sheds B and C**							
F1	Forklift - W of B shed outside	2	1	75% 8h 3.5d	-	-	-	-
F2	Forklift - N of C shed outside	2	1	75% 9h 3d	75% 1h 3n	-	-	-
G	**Sheds D, E and F**							
G1	Trucks	1	2	-	-	40/d 3d	-	15
G2	Trains	1	3	-	-	2/d 3d	2/n 3n	8
~~G3~~	~~Forklift - Train~~	~~2~~	~~2~~	~~33% 4h 3d~~	-	-	-	-
~~G4~~	~~Forklifts - D shed~~	~~2~~	~~2~~	-	-	-	-	-
G5	Straddle Carriers	1	3	50% 8h 3.5d	-	-	-	-
G6	Straddle Carrier D Shed transfers (5 off)	1	3	100% 1.5h 2d	100% 0.5h 2n	-	-	-

Client: Port Otago
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Filename: SP002 Port Otago 2022, 2022 Figure 3 Operational Scenario_SGS1
Prepared by: BJS Date: 2 Dec 2022

DCC supplied data: topography (1m intervals), cadastral, control boundaries, building heights and street numbers
MDA supplied data: Publically available geo referenced aerial imagery, and building footprints traced from imagery
Operational assumptions reviewed and approved: Robin Carlson Date 13 Oct 2019

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Port Otago - Current Port Noise Maps (2022)
Figure 3: Model 5-Day Operational Scenario

Scale @ A3 1:5000
0 25 50 100 150 200 m
N