BEFORE THE WHANGAREI DISTRICT COUNCIL AND NORTHLAND REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of a resource consent application by Northport Limited under section 88 of the Resource Management Act 1991 for a port expansion project at Marsden Point
APPLICATION NO.	APP.005055.38.01 (NRC) LU 2200107 (WDC)

STATEMENT OF EVIDENCE OF CRAIG MICHAEL FITZGERALD

(TERRESTRIAL NOISE)

24 August 2023

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INTRODUCTION

Qualifications and experience

1. My name is Craig Michael Fitzgerald. I am an Associate with Marshall Day Acoustics (**MDA**), specialising in environmental noise and vibration assessments.

2. I have a Bachelor of Engineering (Mechanical) from the University of Auckland. I am a Chartered Engineer (CEng) registered with the Engineering Council (UK). I am a Member of the Acoustical Society of New Zealand and the Institute of Acoustics (UK).

3. I have 19 years' experience as an engineer. For the past 16 years I have worked in the field of acoustics in New Zealand and England. My work has a focus on environmental acoustics for large infrastructure projects, with a specialty in port noise, including appearing as an expert witness for Council and Environment Court Hearings, and Environment Court mediation. I also have experience in architectural acoustics, and have provided advice on sound insulation, room acoustics and mechanical services noise.

4. MDA is the primary noise consultant for New Zealand ports. We regularly work with Northport, Ports of Auckland, Port of Tauranga, Eastland Port (Gisborne), Napier Port, Port Taranaki, CentrePort (Wellington), Port Nelson, Lyttelton Port Company, PrimePort (Timaru) and Port Otago. We also support the New Zealand ports collectively via their environmental forum. Similarly, MDA are supporting Ports Australia to develop their port noise good practice guide. MDA therefore have access to an extensive port noise source data base and extensive experience with port noise best practice measures.

5. My recent and relevant port experience includes:

   (a) Whangārei District Plan (**WDP**) review of the Port Noise provisions. I advised Northport on noise matters for Plan Change 88 (**PC88**). I recommended implementation of New Zealand Standard 6809:1999 Acoustics – Port noise management and land use planning (the **Port Noise Standard**). I presented at the Council hearing[1], participated in the community engagement and Environment Court mediation, then presented expert noise evidence in the Environment Court hearing[2].

[1] PC88 Hearing date 6 December 2019.
[2] NZEnvC 192, decision dated 8 December 2021.

(b) I was engaged by Port Marlborough to implement the Port Noise Standard in the new Marlborough Environment Plan. I was also engaged by Port Marlborough and KiwiRail to prepare the acoustic assessment for the Waitohi Picton Ferry Precinct Redevelopment. This was one of the first major decisions issued using the COVID-19 Recovery (Fast-Track Consenting) Act 2020. The redevelopment features new port yard and ferry berth facilities, as well as reconfigured rail shunting yards and widened approach lines. I lead the acoustic design and assessment reporting, either authoring or reviewing the technical reports addressing construction, road, rail, and port activities.

(c) Large marine infrastructure projects such as the Americas Cup 36, Auckland's Downtown Infrastructure Development Programme and Port Napier's Wharf 6.

(d) Review of District Plan port noise provisions on behalf of Ports of Auckland, Napier Port, Port Taranaki, CentrePort (Wellington) and Port Otago. Furthermore, ongoing port noise management, monitoring and/or review for the ports listed, plus Lyttelton Port Company, Port Nelson and Eastland Port.

6. In 2022, MDA was the winner of the Australian Association of Acoustical Consultants (AAAC) Hugh Vivian Taylor Award (the acoustic industry's top award recognising innovation and advancing the field of acoustics) for my work addressing low frequency ship noise at New Zealand ports.

7. My evidence is presented on behalf of the applicant, Northport. MDA was engaged to undertake a noise assessment of a proposed container terminal expansion east of the existing port (the Project).

8. I have been advising Northport on port noise since 2017. I am familiar with the application site and the surrounding locality. I have read the relevant parts of: the application; submissions; and the Section 42A Report. I either authored or reviewed the noise monitoring and associated technical assessment reports for the Project. These include:

(a) Application, Appendix 4 – Noise Assessment;[3]

(b) Draft Port Noise Management Plan (**NMP**);[4] and

(c) Response to informal clarifications Attachment 2;[5] and

[3] MDA report Rp 002 R07 20200547*, 'Northport Container Terminal Expansion Noise Assessment',* 29 Sep 2022.
[4] MDA report Rp 001 R04 20170776, '*Northport Port Noise Management Plan*', 3 Aug 2022.
[5] MDA letter Lt 002 r01 20200547, '*Northport Vision for Growth (Noise Response to RFI)*', 25 Oct 2022.

(d) A further response to informal clarifications Attachment 2.[6]

Code of Conduct

9. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (2023) and I agree to comply with it. In that regard, I confirm that this evidence is written within my expertise, except where I state that I am relying on the evidence of another witness. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

10. In my evidence, I:

(a) Provide an executive summary of my key conclusions;

(b) Describe the existing noise environment;

(c) Summarise the port noise planning provisions, including the Port Noise Standard;

(d) Predict the port noise levels, including those associated with the Project;

(e) Assess the port noise effects, including effects of the Project;

(f) Recommend port noise controls;

(g) Assess the construction noise;

(h) Respond to the s42A Report;

(i) Respond to submissions raised; and

(j) Comment on draft proposed conditions advanced by Northport.

EXECUTIVE SUMMARY

11. I have measured noise levels in the existing environment and prepared port noise models of the 'current' (2022) and 'future' (2035) (including the Project) representative busy 5-day operations periods.[7] My noise model of the current operations has been validated using measurements as far as practicable. In summary:

[6] MDA memo Mm 005 r01 20200547 CF, '*Open window sound level difference'*, 23 June 2023.

[7] The representative 'busy 5-day' operations period aligns with the relevant period description in clause 6.4.5 of NZS6809. I have used 'busy 5-day' period and 'peak week' interchangeably in my reporting. I find the latter term relatable, but some find it contrasts with the 'representative' period lens. As such, I refer to the 'busy 5-day' period in this evidence to avoid confusion.

(a) Noise monitoring of a representative busy port operations period complied with the permitted WDP noise limits.

(b) The computer noise model for the current (2022) representative busy 5-day operations generally aligns with the noise monitoring results in 2018 and 2023.

(c) Consented Berth 4 operations will require management to ensure cumulative compliance in the future, or a resource consent will need to be obtained to exceed the permitted levels (as proposed by this Project).

(d) The future (2035) busy port operations model predicts a noticeable increase in port noise levels associated with current operations (2022); but a negligible to just-perceptible increase in overall cumulative noise levels from all sources (including Channel Infrastructure and general environmental noise). I predict port activities would continue to comply with the WDP 55 dB L_{day} and 75 dB L_{AFmax} limits but exceed the 45 dB $L_{Aeq\ (15min)}$ night-time limit on occasions.

12. I consider this Project affords an opportunity to implement the Port Noise Standard, which is specifically developed to manage issues of noise generated by ports. The Port Noise Standard states "*mitigation measures may be necessary when the day-night average sound level in a residential community exceeds 55 dB L_{dn}*." By 2035, the closest dwellings in neighbouring communities are predicted to receive port noise levels of up to 54 dB $L_{dn\ (5\ day)}$ in Marsden and 58 dB $L_{dn\ (5\ day)}$ in Reotahi during a busy period with downwind conditions. The annual average noise levels from a fully developed New Zealand port is typically 3 – 5 decibels lower than the peak period.

13. The external daytime port noise levels at the most exposed dwellings in Marsden and Reotahi are predicted to be 48 and 51 dB L_{day} respectively by 2035 (a typical increase of 5 decibels). These levels are well below WDP permitted limits, appropriate for residential use, and would not influence conversation voice level or materially impact general amenity in outdoor spaces, but general annoyance would increase.

14. The external night-time port noise levels are predicted to increase to 47 and 51 dB L_{night} by 2035 for the most exposed dwellings in Marsden and Reotahi respectively. The corresponding predicted levels received inside the most exposed bedrooms are 32 and 36 dB L_{night} in Marsden and Reotahi respectively. Port noise levels would be more audible inside bedrooms on busy nights and intrusive at times with open windows. Some residents would choose to shut windows to improve sound insulation performance.

15. I support the Northport proposed controls for managing the port noise effects:

(a) Adopt resource consent condition noise limits aligned with those recommended in the Port Noise Standard.

(b) Implement an NMP to minimise port noise effects. The NMP would be reviewed at least annually in consultation with the community, including the (then) current port noise contours.

(c) Conditions requiring Northport to offer to mitigate dwellings measured or predicted[8] to be exposed to port noise levels above 55 dB $L_{dn\ (5\text{-}day)}$. The mitigation would constitute an open offer to fund mechanical ventilation, cooling, and/or other mitigation works to maintain satisfactory thermal conditions while achieving an internal design noise level of 40 dB $L_{dn\ (5\text{-}day)}$ in habitable rooms. By 2035, I predict this offer would apply to 16 dwellings in Reotahi and none in Marsden.

EXISTING NOISE ENVIRONMENT

Description of the Environment

16. Northport operates at Marsden Point, on land zoned 'Port Zone' pursuant to the WDP, immediately west of the Channel Infrastructure (previously Refining NZ) site. There are four distinct receiving environments for noise generated by the port:

(a) Reotahi is a coastal settlement on the northern side of the Whangārei Harbour, 1 to 1.5 km from the Northport operations. Existing dwellings are zoned 'Rural Village Residential' in the WDP.

(b) Marsden Bay is a coastal settlement on the southern side of Whangārei Harbour, approximately 500m to 1km west of the Northport log yard. Existing dwellings are zoned 'General Residential'.

(c) Non-noise sensitive industrial areas to the east and south of Northport (e.g. Channel Infrastructure's Marsden Point fuel import terminal and the Carter Holt LVL Plant).

(d) Coastal, Rural and other Open Space Zones are used for recreational purposes during the day.

17. I have visited Northport and the receiving communities of Marsden Bay and Reotahi. The existing noise environment features both natural and anthropogenic (man-made) noise

[8] As informed by the periodic revision of port noise contours required as part of the NMP.

contributions. The natural includes wind and wave noise near the coast, supplemented by bird noise, and insect noise further inland. The anthropogenic sources include low levels of intermittent local road traffic and community noise, underpinned by the background 'hum' of port and other industrial operations (e.g. Channel Infrastructure's ship unloading activities) and the occasional 'bang' from port log handling activities.

Consented Noise Limits

18. The WDP Noise and Vibration (**NAV**) chapter sets port noise limits in NAV.6.1. Northport must comply with the following noise limits in the Marsden and Reotahi residential communities:

    (a) 0700 – 2200 hours (day) 55 dB L_{Aeq} (written hereafter as 55 dB L_{day})

    (b) 2200 – 0700 hours (night) 45 dB $L_{Aeq\ (15min)}$ and 75 dB L_{AFmax}

19. I necessarily refer to many noise measurement metrics in this evidence, so have included a glossary of terms in **Appendix A**. For simplicity, and to enable comparison with metrics used in the Port Noise Standard, I note that the L_{Aeq} noise level over the entire daytime period can be written as L_{day}. Likewise, the L_{Aeq} noise level over the entire night-time period can be written as L_{night}.

20. In my experience, noise emissions from New Zealand ports during peak operating periods do not materially change across the day and night. Therefore, my focus is the more stringent night-time noise limits applying in the Marsden Bay and Reotahi residential zones.

Existing Noise Environment

21. The total representative noise levels in Reotahi, including contributions from refinery and port activities during slightly downwind propagation conditions, have measured above 45 dB L_{A10} and/or 45 dB L_{Aeq} for more than 40 years. The total noise level includes contributions from port, refinery, community, and environmental noise sources (e.g. animal calls, wind in trees and wave noise). The combination of components varies by receiver location, port/refining activities, time of day, and weather conditions.

22. Historic measurements are summarised below, noting that the historic L_{A10} and modern L_{Aeq} measurement descriptors are generally interchangeable for port / refinery 'hum':

(a) 1981[9]: Wakelin Consultants Limited reported refinery noise levels in Reotahi ranging from 40 to 52 dB L_{A10}, with a mean of 45 dB L_{A10}. The wide range in noise levels likely represented the range of environmental and operating conditions.

(b) 1991:[10] MDA measured refinery activities and calculated representative noise contributions of 47 – 48 dB L_{A10} in Reotahi and Marsden in downwind conditions.

(c) 2018:[11] MDA measured representative port and refinery noise levels of 47 dB L_{Aeq} (and 47 dB L_{A10}) in downwind conditions. The survey results formed the basis of the model validation and are summarised from paragraph 23.

(d) 2023:[12] The findings of a recent noise survey align with those from 2018. The results and observations are summarised from paragraph 27.

23. MDA measured existing noise emissions from the Channel Infrastructure site (then Refining NZ) and Northport between May and July 2018. The purpose of the measurements was to establish the representative noise levels from Refining NZ and Northport activities received in the surrounding residential environments. Both short-term attended measurements and long-term unattended measurements were undertaken for the following scenarios:

(a) Baseline (no appreciable noise from Northport or Refining NZ)

(b) Northport activity only

(c) Northport and Refining NZ activity

24. The long-term unattended monitor measured an average night-time noise level of 47 dB L_{Aeq} at 14 The Heights, Reotahi during busy operating periods and downwind conditions. The results aligned with attended noise surveys under downwind conditions, with the representative noise contributions estimated as follows:

(a) Northport 43 dB L_{Aeq}

(b) Refinery 44 dB L_{Aeq}

(c) Other environmental sources 39 dB L_{Aeq}

[9] Wakelin Consultants Limited (July 1981), titled '*The impact of noise from an industrial plant upon a rural area, Marsden Point case study'.*
[10] MDA report 178911RA 1991191A 'Marsden Point Oil Refinery Noise Survey' (May 1992).
[11] MDA report Rp 001 20180532 'Refining NZ and Northport Noise Measurements' (25 Oct 2018).
[12] MDA report Rp 004 20200547 'Northport Noise Monitoring 2023' (04 Aug 2023).

(d) Total 47 dB L_{Aeq}

25. Outside observed short-term monitoring intervals, the long-term port noise contributions were difficult to isolate and quantify. Total noise levels ranged from the high 30s to the low 50s dB L_{Aeq} during individual 15-minute intervals, consistent with the range mentioned in the earlier monitoring reports. Periods of high winds are easily excluded, but periods subject to enhanced propagation under temperature inversion conditions are more difficult to identify, not common, but more likely on calm winter nights (noting the July monitoring period in 2018). The latter resulted in intervals of enhanced propagation conditions that were outside the meteorological window defined in NZS6801:2008 Acoustics – Measurement of Environmental Sound.

26. My assessment report relied on the representative 'busy' port noise contribution of 43 dB L_{Aeq} at 14 The Heights to verify the computer noise model. The 43 dB $L_{Aeq\ (15min)}$ noise contour correlates with the equivalent 48 dB $L_{dn\ (5\ day)}$ contour in the Northport model (discussed in paragraph 61). In my experience, this relationship is consistent at other busy New Zealand ports with comparable operations (e.g. Napier Port, as discussed in paragraph 62 of my evidence).

27. Channel Infrastructure stopped refining activities at their site in June 2022, but the refinery site continues to operate as a shipping terminal and land-based storage facility. Following this operational change, I was asked to review the representative community noise levels received in the Marsden and Reotahi communities in the absence of refining activities.

28. I measured continuous noise levels for one month spanning May and June 2023 at two locations in Reotahi and one location in Marsden. My colleague (Mr Peter Ibbotson[13]) and I supplemented the monitoring data with attended measurements. In summary:

    (a) Refinery ship unloading activities dominated the noise levels received in Norfolk Reserve (Reotahi) under light downwind conditions and with no ships or audible activities at Northport. The total noise level measured 45 dB L_{Aeq} and background 42 dB L_{A90}. The refinery noise contributions were comparable to those measured in 2018. I note that a refinery ship was present on approximately half of the days during the 2023 monitoring period. Therefore, refinery noise remains relevant to the total ambient noise levels received in Reotahi.

[13] Mr Ibbotson has over 20 years of acoustic consulting experience, including environmental noise from multiple ports and the refinery.

(b) The long-term unattended monitor at 131 Reotahi Road measured representative night-time noise levels of 42 – 45 dB L_{night} during busy operating periods and downwind conditions. The comparable levels at a monitor at 28 Albany Road in Marsden were typically four decibels lower. The port noise model remains representative of busy periods under common weather conditions.

(c) Port noise complaints were correlated with high noise events (e.g. 'bangs'). Port noise events are regularly audible, but loud events between 65 and 75 dB L_{AFmax} are rare and not representative of typical operations.

PORT NOISE PLANNING PROVISIONS

29. Mr Hood and Mr Mitchell address the plan and policy context for the application. I only address the relevant noise provisions as they relate to my assessment.

Regional Coastal Plan for Northland (RCP) & Proposed Regional Plan for Northland (nPRP)

30. The relevant noise policies and rules in the RCP and nPRP generally align with, or defer to, the WDP controls discussed below.

Whangārei District Plan (WDP)

31. Northport operations subject to this assessment are on land zoned 'Port Zone' within 'Port Operations Area A'. Port Operations Area A contains, and is limited to, the functions and operations of the Port. This Project proposes an expansion of port operations into the adjacent Coastal Marine Area (**CMA**).

32. The PORTZ chapter of the WDP seeks to ensure a balance between the continued and future operation and development of the Port and managing effects on the environment. The Port noise limits in this chapter are summarised in paragraph 18 above.

33. To minimise reverse sensitivity effects, NAV.6.5 sets minimum Sound Insulation Requirements for the design and construction of new noise sensitive activities established in high noise environments. The rule provides external design noise levels, spectrum shapes[14] and maximum internal noise levels for habitable spaces. However, while this rule applies at other locations in Whangārei, for example, near Port Nikau, it does not apply in relation to Northport. I understand this is because Northport is currently positioned at considerable distance from noise sensitive receivers in Marsden Bay and

[14] Octave band noise levels to represent the character of the noise on which the dwelling design shall be based.

Reotahi - meaning that minimum sound insulation requirements have not been deemed necessary in these receiving environments to date due to the relatively low levels of port noise.

National Planning Standards

34. Chapter 15 of the National Planning Standards, titled 'Noise and Vibration Metrics Standard', requires that *"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:

    (a) New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound; and

    (b) New Zealand Standard 6809:1999 Acoustics – Port noise management and land use planning (the Port Noise Standard).

35. The National Planning Standards supporting document titled 'Guidance for 15. Noise and Vibration Metrics Standards'[15] notes that the Noise and Vibration Metrics Standard "…*does not provide direction for plan content such as noise limits",* and that *"although the planning standards refer specifically to 'noise measurement methods and symbols' of the NZAS [New Zealand Acoustical Standards, e.g. the Port Noise Standard] and specific parts of other noise and vibration standards, the standards should be read as a whole, to provide context for specific provisions in the NZAS".*

36. The Port Noise Standard is used for 11 of the 13 major New Zealand Ports (including Lyttelton, Napier and Otago).[16] I was involved with the most recent adoption of the Port Noise Standard in the Marlborough Environment Plan. In my experience, the implementation of the Port Noise Standard methods[17] is reasonably consistent, but the specific implementation of noise limits (if there are any), land use controls, sound insulation controls and management arrangements vary for individual ports.

[15] Published in April 2019 by the Ministry for the Environment; Publication number: INFO 874.

[16] The remaining two are Northport and Ports of Auckland. The Ports of Auckland port noise provisions originate from the Ferguson Wharf Environment Court decision which predates the Port Noise Standard. However, a draft version of the Port Noise Standard was discussed in evidence and many of the rules and management concepts adopted align with the Standard.

[17] NZS 6809:1999, para 1.4, states "*The Standard provides details of methods for:*

(a) Identifying land areas subject to current and future port noise, by prediction of day-night average sound levels;

(b) Setting boundaries to define such land areas;

(c) Imposing land use controls on noise-sensitive activities within these areas; and

(d) Establishing noise limits to control port noise which is measured beyond these boundaries."

37. The specific 'noise measurement methods' in Section 5 of the Port Noise Standard refers to the measurement methods in NZS 6801. However, the Port Noise Standard supplements NZS 6801 with specific direction for compliance measurements undertaken indoors with the windows closed.

38. With regards to specific 'symbols', Section 4.1 of the Port Noise Standard requires the L_{dn} descriptor to be used for the prediction of port noise, while Section 4.2 includes a wider range of descriptors for monitoring purposes (L_{dn}, L_{Aeq} and L_{AFmax}).

Port Noise Standard

39. The title of the Port Noise Standard "*Port Noise Management and Land Use Planning*", reveals the 'two handed' approach of the Standard. The objective of the Standard is to ensure the long-term compatibility of ports and their neighbours by the application of both appropriate land use planning techniques and the management of noise emissions from the port. 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 existing and future activities.

40. In summary, the Port Noise Standard uses Noise Control Boundaries to:

    (a) Implement land use planning controls in the District Plan to avoid future development inside the noise boundaries; and

    (b) Control noise emissions from the port with noise limits at the Boundaries and with an NMP, to minimise noise effects from day-to-day activities such as 'banging' of log and container handling.

41. The Port Noise Standard recommends the implementation of Inner and Outer Control Boundaries on planning maps. The Control Boundaries represent the predicted 65 dB $L_{dn\ (5\text{-}day)}$ (Inner Control Boundary) and 55 dB $L_{dn\ (5\text{-}day)}$ (Outer Control Boundary) levels respectively over a busy 'future' 5-day operating period. The Port Noise Standard suggests the 'future' scenario should be at least 10 years in the future and is commonly 10 – 15 years to represent the potential envelope of effects over the life of the District Plan.

42. The L_{dn} descriptor, commonly referred to as the Day-Night Level, is the A-weighted energy averaged sound level, calculated over a 24-hour period. The night-time component, between 10pm and 7am (i.e. L_{night}), is penalised/weighted by adding 10 decibels to reflect the greater sensitivity to noise at night.

43. The Port Noise Standard addresses both existing and new ports. Paragraph 1.1 sets out the scope of the Standard, which states "*It is intended for application to existing ports, new ports and for changes to existing ports*". Supporting paragraph C1.4 notes that "*mitigation measures may be necessary when the day-night average sound level in a resident community exceeds 55 dBA L_{dn}*".

44. Northport proposes to introduce the key concepts in the Port Noise Standard via its management of noise effects in proposed resource consent conditions, including mitigation of dwellings exposed to port noise levels above 55 dB $L_{dn\ (5\text{-}day)}$ and the implementation of an NMP. I support this approach. While outside the scope of the current resource consent application, I would also support the implementation of the land use planning aspects of the Standard in any future District Plan review or plan change.

PORT NOISE LEVELS

Modelling Methodology

45. I have used a noise model to predict the 'energy average' noise emissions from Northport operations over a busy 5-day operating period. The two modelled scenarios are:

    (a) Current Port activities (2022); and

    (b) Future Port activities (2035).

46. The noise modelling process consists of the following parts, detailed in the following paragraphs:

    (a) Noise sources;

    (b) Operational scenario;

    (c) Modelling methodology; and

    (d) Calibration.

47. The detailed noise source data for the model was prepared from representative machinery data measured by myself and my colleagues at MDA 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. I then cross checked the calculated sound powers against data for similar equipment.

48. My colleague (Mr Ben Lawrence[18]) and I worked with Mr Blomfield from Northport to ensure the modelling operations assumptions reflect the representative busy periods of port activity. The modelling assumptions in each scenario include a description, the number of, and an equivalent 'on-time' description for each noise source.

49. I set up and oversaw the preparation of a computer-based noise model[19] using the SoundPLAN noise propagation software. SoundPLAN is an internationally recognised computer noise modelling programme. It 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.

50. NZS 6801:2008 cross references ISO 9613-2:1996[20] for a suitable sound propagation algorithm for modelling. Accordingly, the noise model calculation settings align with the standard settings in ISO 9613-2:1996. Most notably, a slightly downwind condition in all directions in accordance with the meteorological window specified in NZS 6801:2008. ISO 9613-2, Section 8, Note 22, indicates a propagation accuracy of +/- 1dB is normal, values greater than 2 dB are exceptional, but may be as high as 5 dB. The accuracy statements are limited to receiver distances of up to 1,000m. The most exposed Marsden residents are well less than 1,000m from Northport, but the closest Reotahi residents are just beyond 1,000m. Therefore, the propagation accuracy should be expected to be slightly wider than normal for Reotahi.

51. I have recently reviewed the model settings again following the 2023 monitoring results (refer paragraph 27 above). The propagation algorithm settings remain appropriate. However, I noticed that the ground absorption co-efficient of water was set to 0.2[21]. In hindsight, a value of 0.0 would be more conservative and will be adopted for future iterations of the noise model. The setting change increases the predicted noise levels by approximately 1 decibel for the most exposed dwellings on the Reotahi shore front, 0.5 decibel for dwellings further back in Reotahi, and result in no change for dwellings in Marsden or those in Reotahi with no clear line of sight to the port. In summary, the noise contours remain within the acceptable modelling tolerances.

[18] Mr Lawrence has 9 years of acoustic consulting experience, including a specific focus on environmental noise from port and marine activities.
[19] The model inputs and calculation method are detailed in Appendix 4 – Noise Assessment, Section 4.4.
[20] ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation.
[21] Values range from 0 for hard ground with a perfect reflective surface to 1 for soft ground with no reflection.

Current Port Noise Maps (2022) and model verification

52. The Current Port Noise Maps (2022), and the associated port operations assumptions, are included in my assessment report as Appendix F (and are reproduced in this evidence as **Appendix C**).[22]

53. I used the results from the monitoring and attended noise surveys in 2018 to verify the shape of the current port noise contours at multiple locations. The current noise model predicts:

    (a) Reotahi: 47 dB $L_{Aeq\ (15min)}$ at the most affected residential interface (126 Reotahi Rd) and 43 dB $L_{Aeq\ (15min)}$ at the long-term monitoring position (14 The Heights) during a busy night-time period. The predicted noise levels are generally within acceptable modelling tolerances (i.e. within 1 – 2 decibels) compared with measured levels, so align well with the measured levels on a representative busy night.

    (b) Marsden Bay: 43 dB $L_{Aeq\ (15min)}$ at the interface. This is noticeably higher than the measured levels 33 – 35 dB $L_{Aeq\ (15min)}$ in the 2018 survey but consistent with noise levels measured in the 2023 survey. The difference is attributed to the lack of yard activities in the western part of the Port and wind direction during the attended surveys in 2018.

54. I consider the model of the existing port operations to be representative of current busy period port noise emissions.

Consented Berth 4 Activities

55. Northport holds resource consents for, but has not yet constructed, Berth 4. However, current busy port operations periods are at, or near, the permitted night-time noise limits already. Therefore, future night-time operations on Berth 4 would need to be managed to ensure ongoing compliance, or a resource consent will need to be obtained to infringe the permitted levels.

56. As outlined in the AEE and later in this evidence, Northport proposes a set of noise controls through resource consent conditions that will apply to all port activities (current, consented, and future).

[22] The appendix references in this evidence match the references in my AEE report.

Future Port Noise Maps (2035)

57. The Future Port Noise Maps (2035), including the associated port operations assumptions, are included in my assessment report as Appendix G (and are reproduced in this evidence as **Appendix D**).

58. I have used the future noise contours to inform port noise limits and identify existing dwellings that could be offered mitigation by Northport (refer paragraph 83 below).

59. The Project seeks resource consent for an increase in container activity, which brings with it an increase in associated noise levels. Essentially, the 'hum' of the port is predicted to get louder with growth, based on today's technology. However, in my experience with other New Zealand ports, volume throughput has increased significantly in recent years without associated increases in busy period noise level. This is primarily due to investment in modern equipment and improvements in noise management.

60. I have not made any adjustment of noise source levels in the modelling to account for potential equipment improvements over time, so I consider the results represent a generally conservative approach. The exceptions are that I have assumed the future use of modern Rubber Tire Gantry (RTG) and Quay Cranes, and electric mafi truck units, aligned with my experience of new equipment being procured at other NZ ports.

61. The detailed noise contours are included in **Appendix D**. I have summarised the key port noise modelling results in the table overleaf for the most exposed receivers in Marsden Bay and Reotahi, and the long-term noise monitoring position in paragraph 24. The predicted noise levels for other receivers generally drop off with increased distance from the port. I note that the cumulative noise level, inclusive of community, environmental and other industrial activities, will result in higher cumulative noise levels. I address the cumulative noise effects later in my evidence from paragraph 74.

62. My modelling focuses on the representative busy 5-day operations, and the highest representative 15-minute night-time interval. In my experience, the annual average noise levels for a fully developed New Zealand port are typically 3 – 5 decibels below the modelling predictions based on long-term measurement results from other similar sized ports with a similar mix of proposed operations (e.g. Napier).

Table **1:** Port noise predictions at closest receivers

Location	Day-Night (24h)	Day (7am – 10pm)	Night (10pm – 7am)	
	dB $L_{dn\ (5\text{-}day)}$	dB L_{day}	dB L_{night}	dB $L_{Aeq\ (15min)}$
Current (2022)				
38 Albany Rd, Marsden (most exposed west)	48	42	41	43
126 Reotahi Rd, Reotahi (most exposed north)	52	46	46	47
14 The Heights, Reotahi (monitoring position)	48	42	42	43
WDP Operative noise limits	-	55	-	45
Future (2035)				
38 Albany Rd, Marsden (most exposed west)	54	48	47	48
126 Reotahi Rd, Reotahi (most exposed north)	58	51	51	52
14 The Heights, Reotahi (monitoring position)	55	48	48	49
Port Noise Standard recommended noise limits:				
- Inner Control Boundary	65	-	60	65
- Outer Control Boundary	55	-	50	55

63. In summary, I predict:

(a) Current busy port activities comply with the WDP 55 dB L_{day} daytime noise limit, and are at, or near, the 45 dB $L_{Aeq\ (15min)}$ night-time limit. The current activities are also below the 55 dB L_{dn} threshold recommended by the Port Noise Standard.

(b) Future busy port activities would continue to be within with the WDP 55 dB L_{day} daytime limit but would infringe the 45 dB $L_{Aeq\ (15min)}$ night-time limit at 55 dwellings in Reotahi and 7 in Marsden. The predicted infringement is up to 7 decibels at the most exposed dwelling and the levels are controlled by the proposed expanded container operations. The detailed predicted noise levels for all 62 dwellings were included in response to requested clarifications by WDC.[23]

(c) Future port activity noise will remain below 55 dB $L_{dn\ (5\text{-}day)}$ in Marsden but up to 3 decibels above this threshold in Reotahi.

(d) Representative discrete noise events from log or container placement will continue to comply with the WDP 75 dB L_{AFmax} night-time limit but occur more frequently with increasing activity.

[23] MDA letter Lt 002 r01 20200547, '*Northport Vision for Growth (Noise Response to RFI)*', 25 Oct 2022.

PORT NOISE EFFECTS

Change in noise level

64. The subjective impression of changes in noise can generally be correlated with the numerical change in noise level. I acknowledge that people may subjectively have an annoyance reaction to a greater or lesser degree, depending on their perception of the port and/or the Project, however these individual and subjective variances are not used as a basis for assessing and controlling noise effects. Instead, an objective approach based on general population level sensitivities is used. The following table summarises the general correlation between noise level changes and the immediate subjective response.[24] I consider the use of this table is conservative because the perception of change is less pronounced when it occurs gradually over time, as it would here. Nonetheless, in this context,[25] subjective perception of a noise level change can be translated into scale of impact. This effect is based on people's annoyance reaction to noise level changes.

Table 2: Noise level change compared with general subjective perception

Noise level change	**General subjective perception**[26]	**Impact**[27]
1 – 2 decibels	Insignificant/imperceptible change	Negligible
3 – 4 decibels	Just perceptible change	Slight
5 – 8 decibels	Appreciable to clearly noticeable change	Moderate
9 – 11 decibels	Halving/doubling of loudness	Significant
>11 decibels	More than halving/doubling of loudness	Substantial

Daytime 'hum' (outdoor areas)

65. In my opinion, daytime noise effects are primarily associated with outdoor amenity.

66. Table 1 shows that the most exposed dwellings currently receive port noise levels of up to 42 and 46 dB L_{day} in Marsden and Reotahi respectively. These levels are audible at times but do not influence conversation voice level or materially affect general amenity in outdoor spaces.

[24] For instance, LTNZ Research Report No. 292: Road traffic noise: determining the influence of New Zealand Road surfaces on noise levels and community annoyance, Table 18. We predict a similar correlation for port noise.
[25] Including the noise characteristics and levels involved.
[26] Based on research by Zwicker & Scharf (1965); and Stevens (1957, 1972).
[27] The descriptions in this column are based on my understanding of the perception in change in noise level. This table and impact descriptions have been used for many major roading projects to explain the effects in RMA terms.

67. I predict future busy period port noise levels would increase noticeably (typically 5 decibels) in both Marsden and Reotahi. The dwellings most exposed to port noise are predicted to receive busy period levels of 48 and 51 dB L_{day} respectively. These levels are still well below the 55 dB L_{day} permitted level in the WDP. I consider they are appropriate for residential use and would still not influence conversation voice level or materially impact general amenity in outdoor spaces. However, general annoyance would likely increase.

Night-time 'hum' (indoor areas)

68. Residential communities are more noise sensitive at night, primarily in relation to sleep disturbance.

69. Table 1 shows that the most exposed dwellings currently receive port noise levels of 41 and 46 dB L_{night} in Marsden and Reotahi respectively. The corresponding noise levels received inside bedrooms with the windows open[28] are predicted to be approximately 26 and 31 dB L_{night} respectively. In general, port noise would be audible at times inside bedrooms with the windows open but generally acceptable for most of the population.

70. I predict future busy period noise levels would increase noticeably (typically 5 decibels) in both Marsden and Reotahi to 47 and 51 dB L_{night} respectively for the most exposed dwellings. The corresponding noise level received inside bedrooms with the windows open is predicted to increase proportionally to 32 and 36 dB L_{night}. Port noise levels would be clearly audible on busy nights and intrusive at times inside bedrooms with open windows. Some residents may choose to shut windows to improve sound insulation performance during these busy times.

Intermittent noise events

71. I predict no change to the representative L_{AFmax} noise event level (e.g. container or log placement). However, I do predict an increase in the number of representative noise events, in proportion to the increase in future port activities.

72. In my experience, port noise complaints are often aligned with outlier noise events, such as closing ship hatches 'hard' or inadvertently dropping a log or logs into the bottom of the ship's hold. These events are not regular, repeatable, or predictable, but the number of outlier events should reduce as port noise management measures continue to evolve in accordance with the proposed NMP.

[28] Assumes a typical window open on security stays for ventilation purposes (e.g. 100mm opening width).

73. The 2023 monitoring (summarised in paragraphs 27 and 28) included a study on representative noise events received in Marsden and Reotahi. It found that port noise events are regularly audible, but loud events between 65 and 75 dB L_{AFmax} are rare and not representative of typical operations. Regardless, Northport has identified that most noise complaints relate to 'banging' and occur in slightly downwind or calm conditions. Northport has used this experience to create a real-time weather watch 'noise-risk'[29] website for stevedores. The 'traffic light' indicator is used to influence the timing of 'hard loading' activities to minimise noise effects received in the neighbouring communities, including any nights with enhanced propagation conditions.

Cumulative noise effects

74. The current busy port night operations period was measured in 2018 at 14 The Heights, Reotahi. With reference to paragraph 24, the cumulative noise level (47 dB $L_{Aeq\ (15min)}$) was a mix of Northport (43 dB $L_{Aeq\ (15min)}$), Refinery (44 dB $L_{Aeq\ (15min)}$), and other environmental and community components (39 dB $L_{Aeq\ (15min)}$).

75. As noted, Channel Infrastructure stopped its refining activities in June 2022. The recent 2023 noise monitoring survey found refinery noise contributions remain similar to those measured in 2018. Therefore, for the purposes of this cumulative effects assessment, I have assumed the Channel Infrastructure contribution is unchanged at 14 The Heights, Reotahi.

76. Table 3 below shows the predicted change in cumulative noise level and the associated subjective change in level at the most exposed dwelling in Reotahi (126 Reotahi Rd). I have conservatively assumed the same representative contributions from Northport, Channel Infrastructure and the environment despite the dwelling being closer to Channel Infrastructure and the CMA than Northport. In this example, and generally further afield, I predict a noticeable increase in port noise levels, but a negligible to just-perceptible increase in cumulative noise levels. The table includes the equivalent modelled $L_{dn\ (5\text{-}day)}$ port noise level to enable comparison with the noise contours, proposed port noise limits and mitigation thresholds. The changes would be less noticeable outside the busy operations periods.

[29] https://northport.co.nz/weatherfeed

Table 3: Cumulative noise levels and subjective change at 126 Reotahi Rd, Reotahi

Scenario	Northport		Channel Infrastructure	Other/Enviro	Cumulative	Change
	dB $L_{dn\ (5\ day)}$	dB $L_{Aeq\ (15min)}$	dB $L_{Aeq\ (15min)}$	dB $L_{Aeq\ (15min)}$	dB $L_{Aeq\ (15min)}$	dB $L_{Aeq\ (15min)}$
Predicted current (2022) pre refinery shut down June 22	52	**47**	44	39	**49**	-
Estimated current (2023) post refinery shut down June 22	52	47	44	39	**49**	Negligible decrease in cumulative level
At 55 dB $L_{dn\ (5\ day)}$ mitigation threshold predicted between 2022 and 2035	55	**49**	44	39	**50**	Negligible increase in cumulative level
Predicted future (2035) fully developed port	58	**52**	44	39	**53**	Moderate increase in port noise, but a just-perceptible increase in cumulative level

PORT NOISE CONTROLS

Northport proposed controls

77. I support the following controls proposed by Northport, through consent conditions, to manage noise effects:

(a) Port noise limits aligned with those recommended in the Port Noise Standard.

(b) An NMP to minimise port noise effects. The NMP would be reviewed at least annually in consultation with the community, including the (then) current port noise contours.

(c) Northport would offer to mitigate any dwellings measured or predicted[30] to be exposed to port noise levels above 55 dB $L_{dn\ (5\text{-}day)}$. The mitigation would constitute an open offer to fund mechanical ventilation, cooling, and or other mitigation works to maintain satisfactory thermal conditions while achieving an internal design noise level of 40 dB $L_{dn\ (5\text{-}day)}$ in habitable rooms. I predict that this would apply to 16 dwellings in Reotahi and none in Marsden by 2035.

[30] As informed by the periodic revision of port noise contours required as part of the NMP.

Port noise limits

78. The Port Noise Standard focusses on the management of long-term port noise effects. The $L_{dn\ (5\text{-}day)}$ is the primary metric used throughout the Port Noise Standard and is the metric that must be used for the prediction of port noise (refer paragraph 38). It is also the most stable and reliable indicator of long-term noise effects. Based on my experience of undertaking and reviewing long-term noise monitoring at other New Zealand ports such as Port of Napier and Port Otago, the $L_{dn\ (5\text{-}day)}$ metric also reliably controls compliance. This is also the case for Northport (as shown in the Table 1 above).

79. The Port Noise Standard recommends a set of noise limits apply at an Inner Noise Control Boundary represented by the predicted 65 dB $L_{dn\ (5\text{-}day)}$ noise contour. However, the highest predicted future noise level in Reotahi is only marginally above the recommended Outer Control Boundary noise limit of 55 dB $L_{dn\ (5\text{-}day)}$. Therefore, to improve relevance, I have recommended the following table of adapted noise limits, which are in proportion to those recommended by the Port Noise Standard, but lowered to align with the highest $L_{dn\ (5\text{-}day)}$ noise level predicted in my future scenario (2035). The noise limits would apply cumulatively to existing, consented, and proposed (i.e. Project) activities in Port Operations Area A.

Table 4: Recommended port noise limits for Port Operations Area A

Location	Day-night (Long term)	Night (Short term)
At any point on land in the General Residential and Rural Village Residential Zones	**58 dB $L_{dn\ (5\text{-}day)}$**[31] 61 dB $L_{dn\ (1\text{-}day)}$	53 dB L_{night} 58 dB $L_{Aeq\ (15\ min)}$ 75 dB L_{AFmax}

80. A typical port noise environment on a busy night can be described as a constant 'hum', with little fluctuation. In my experience, fluctuation of the 'hum' between individual 15-minute intervals is more evident in quieter low or shoulder seasons. In my view, the other limits recommended in the Port Noise Standard are supplementary controls to inform attended short-term monitoring and management indicators. As such, while the $L_{dn\ (1\text{-}day)}$ and $L_{Aeq\ (15min)}$ limits may appear liberal, they simply provide certainty that excessive fluctuation will not occur. They do not control compliance at well-managed ports.

[31] Section 4.1 of the Port Noise Standard requires the L_{dn} descriptor to be used for the prediction of port noise.

Noise Management Plan

81. The Port Noise Standard recommends that an NMP should be developed to complement the proposed planning controls. 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*".

82. I prepared a draft NMP with Northport. It was included as Appendix H of my assessment report. The NMP is consistent with the port noise management requirements in Section 8 of the Port Noise Standard. Northport proposes through conditions that the NMP, including the (then) current port noise contours, would be reviewed at least annually in consultation with the community.

Mitigation

83. I have outlined above the mitigation approach proposed in conditions. Following the proposed (at least) annual review of the current noise contours in the NMP (paragraph 82), Northport would be required to offer mitigation to any further dwellings exposed to port noise levels above 55 dB $L_{dn\ (5\text{-}day)}$. This threshold aligns with Port Noise Standard comment C1.4 where it states: "*mitigation measures may be necessary when the day-night average sound level in a resident community exceeds 55 dBA* L_{dn}".

84. The following table demonstrates the proposed 55 dB L_{dn} mitigation threshold is lower than the 60 or 65 dB L_{dn} thresholds applied routinely at other New Zealand ports (and airports).

Table 5: New Zealand port funded mitigation thresholds for existing dwellings

Standard/Port	Noise Levels (dB L_{dn})		Description
	External Threshold	Indoor Criterion	
Port Noise Standard:			
- Existing ports	None	-	No requirement to mitigate existing dwellings.
- New ports	-	45	Recommended for new and altered dwellings.
Lyttelton Port Company	65	45	Aligns with Port Noise Standard for new dwellings.
Napier Port:			
- Operative DP	65	45	Aligns with Port Noise Standard for new dwellings.
- Port mitigation scheme	60	40	Napier Port current mitigation scheme.
Port Nelson and Port Otago	60[32]	40	Aligns with Napier Port current mitigation scheme.
Ports of Auckland, Centreport (Wellington) and Port Taranaki	None	-	No requirement to mitigate existing dwellings, primarily because there are no existing dwellings within their Port Inner NCB.
Northport (proposed)	55	40	Best practice for a 'new port'.

85. The Port Noise Standard is similar to New Zealand Standard NZS 6805:1992 "Airport noise management and land use planning". District Plan rules for airports are generally consistent with those for ports in the table above. Many airports, including Hawkes Bay Airport, have no requirement to mitigate existing dwellings, generally because there are none within their noise control boundary. In other cases, the threshold for mitigating existing dwellings is between 60 – 65 dB L_{dn}, and the internal design criterion is between 40 – 45 dB L_{dn}. This includes Auckland, Rotorua, Wellington, Christchurch and Queenstown airports.

86. In summary, based on my recommendations, Northport is proposing indoor amenity standards that in my opinion represent 'best practice' rather than 'code minimum'. Furthermore, the external threshold trigger for mitigation is more aligned with requirements for a new port, rather than an existing port.

[32] In special cases, there is provision for acoustic treatment for houses between 55 - 60 dB L_{dn}. This is assessed on a case-by-case basis following a recommendation from the Port Noise Liaison Committee. Port Otago is required to provide technical advice, and both Port Nelson and Port Otago may offer to contribute to the cost of acoustic treatment.

87. The annual review allows effects to be identified and mitigated in a timely manner. This means that it is in Northport's interest to keep their noise footprint as small as practicable (e.g. investment in quieter equipment or timing of loud activities during the day). I support this approach, and in my experience consider it works well at other New Zealand ports, such as Port of Napier and Port Otago.

88. I predict that 16 dwellings in Reotahi would be eligible for mitigation, and none in Marsden by 2035. The detailed predicted noise levels for all 16 dwellings are included in Appendix E of my assessment report (and are reproduced in this evidence as **Appendix B**). The predicted noise levels for the most exposed façades range from 55 – 58 dB $L_{dn\ (5\text{-}day)}$.

89. I recommend (and Northport has proposed through conditions) that mitigation should 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 recommended limit for existing ports of 45 dB $L_{dn\ (5\text{-}day)}$ and would therefore provide better amenity.

90. The difference between the highest predicted future noise level of 58 dB L_{dn}, and the indoor design level of 40 dB L_{dn} is 18 decibels. In my experience, this would simply require windows and any external doors to be closed and a means of alternative ventilation or cooling provided (e.g., a heat pump or similar). It would not necessitate changes to building cladding or window pane type/thickness. Mechanical ventilation and/or cooling of habitable rooms will enable occupants to close the windows during busy periods, or at any time at their discretion, and maintain a suitable indoor environment.

91. I predict that by 2035, a further 7 dwellings in Marsden and 39 in Reotahi would above the WDP 45 dB $L_{Aeq\ (15min)}$ noise limit, but remain below the 55 dB $L_{dn\ (5\text{-}day)}$ noise mitigation threshold. These dwellings would not be eligible for the proposed port funded mitigation. I predict the scale of infringement of the WDP 45 dB $L_{Aeq\ (15min)}$ noise limit ranges from 1 – 4 decibels. The cumulative change in noise levels and the associated noise effects would be less pronounced (as demonstrated in paragraph 76).

CONSTRUCTION NOISE

92. I predict the Project construction works will comply with the relevant WDP construction noise rules. I summarise the construction noise effects as follows:

(a) Day: The predicted levels would be comparable to the ambient environment but may be noticeable due to the different character (e.g. the piling works).

(b) Night: All potential night-time activities are predicted to comply with the night-time construction noise limits and would be largely indistinguishable from normal port activity, including excavation, dredging, equipment/material deliveries and concrete pours.

RESPONSE TO THE SECTION 42A REPORT

Summary

93. I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly the Council peer review prepared by Mr Peter Runcie (from SLR) attached as Appendix C7 'Terrestrial Noise'. In summary:

(a) Construction noise:[33] Mr Runcie generally agrees with my assessment of construction noise and vibration and considers the effects would be reasonable. Mr Runcie recommends that a construction noise management plan (CNMP) is implemented to minimise effects. I generally agree with his recommendation.

(b) Daytime port operations noise:[34] Mr Runcie acknowledges that the predicted daytime noise levels remain below the permitted levels in the WDP (55 dB L_{Aeq}).

(c) Night-time port operations noise:[35] Mr Runcie acknowledges the noticeable increase in port noise proposed, supports the management of port noise effects using a NMP, and the proposed port funded mechanical ventilation and cooling mitigation (or other upgrades as required) to achieve 40 dB $L_{dn\ (5\text{-}day)}$ inside bedrooms. However, he recommends tailoring the short-term noise limits to match the predicted noise level and lowering the mitigation eligibility threshold. I disagree with his suggestions. I address both of these residual matters below.

(d) Matters raised in submissions:[36] Mr Runcie notes the relevant submissions raise general concerns around increases in noise, changes to the WDP noise limits and the adoption of improved technology to mitigate noise via the NMP.

[33] S42A report paragraph 350, and Appendix C7 Section 5.1.
[34] S42A report paragraph 354, and Appendix C7 Section 5.1.
[35] S42A report paragraph 358 – 365, and Appendix C7 Section 5.1.
[36] S42A report Appendix C7 Section 6.1.

(e) Conclusion:[37] Mr Runcie considers the overall noise effects would be reasonable subject to recommended changes to conditions. I address the proposed amendments to the conditions below.

Noise Limits

94. Mr Runcie recommends tailoring the short-term noise limits to match the predicted noise levels. I disagree with this approach for the reasons discussed in paragraphs 78 – 80. In my view, short-term limits in proportion to those recommended in the Port Noise Standard are supplementary controls to inform attended short-term monitoring and management indicators. They simply provide certainty that excessive fluctuation will not occur. They do not control compliance at well-managed ports.

Mitigation Eligibility Threshold

95. Mr Runcie recommends that the mitigation provisions should be extended to existing dwellings between 50 – 55 dB $L_{dn\ (5\text{-}day)}$ to account for situations where the noise level reduction across a representative open window is less than 15 decibels.

96. In a request for further information (item 3), Mr Runcie pointed out that a conservative assumption is 10 decibels and requested evidence to support the representative assumption of 15 decibels. My response[38] provided theoretical support for the representative assumption. I supplemented my response with a further memo[39] detailing representative measurements for bedrooms in six bungalows and mid-century dwellings overlooking another New Zealand port. However, I understand this further memo was only received by Mr Runcie after he had provided his opinion.

97. The memo found that the noise level reduction across a representative open window ranged from 14 – 21 decibels, with an arithmetic average of 17 decibels. The range is partly due to site specific variables, such as window type, how it is hung, window size, and room constants (e.g., room dimensions and furnishings). Therefore, I consider the conventional assumption of 15 decibels remains representative for a typical bedroom with one window open on a 100mm security stay. I recommend that the mitigation trigger level should remain at 55 dB $L_{dn\ (5\text{-}day)}$.

[37] S42A report paragraph 367, and Appendix C7 Sections 5.2 and 7.1.
[38] MDA letter Lt 002 r01 20200547, '*Northport Vision for Growth (Noise Response to RFI)*', 25 Oct 2022.
[39] MDA memo Mm 005 r01 20200547 CF, '*Open window sound level difference*', dated 23 June 2023.

Conditions

98. Mr Runcie recommends[40] a series of amendments to the proposed conditions. His recommendations, along with a series of other changes, are reflected in the draft conditions recommended by the S42A report. I have referred to the conditions as numbered in the S42A report:

99. NRC conditions:

(a) NRC condition 105: I generally support the recommendation for a CNMP subject to refinement of the suggested wording. However, NRC condition 60 already requires the Construction Environmental Management Plan (CEMP) to include a section on construction noise. The section must be prepared by a Suitably Qualified and Experienced Person (SQEP) in accordance with condition 61. A SQEP would prepare the construction noise section of the CEMP in accordance with NZS 6803:1999 Annex E2, titled "*Noise management plans*". The CEMP condition already includes the CNMP as an integrated component.

(b) NRC conditions 106: Condition 106 appears to be targeted at underwater noise effects from dredging activities (I do not consider it is necessary for terrestrial noise). If so, I consider the content may be more appropriately incorporated in the Marine Mammal Management Plan (MMMP) condition 88.

100. WRC conditions:

(a) WDC conditions 34 – 36: Aligned with my comments on NRC condition 105 above, WDC condition 28 already requires the CEMP to include a section on construction noise prepared by a SQEP.

(b) WDC conditions 37 and 39: Construction vibration controls are proposed that simply repeat the WDP permitted standards in part. I predict construction vibration received in the community will be negligible, so there is no material effect to control. Furthermore, reproducing a permitted standard in part compromises enforcement. I recommend deleting the construction vibration additions. If retained, the following should be added: *Construction vibration shall be measured and assessed in accordance with German Standard DIN 4150-3:2016 "Vibrations in buildings – Part 3: Effects of vibration on structures*".

[40] S42A Report, Appendix C7, Section 8.3.

(c) WDC condition 72: I do not support the change to the night-time noise limits for the reasons in paragraph 94 above.

(d) WDC condition 73: I do not support with the change to the mitigation trigger level for the reasons in paragraphs 95 – 97 above.

RESPONSE TO ISSUES RAISED IN SUBMISSIONS

101. I have reviewed submissions relevant to my evidence, numbered: 6, 9, 11, 12, 14, 18, 24, 27, 37, 53, 80, 92, 103, 104, 118, 121, 124, 125, 126, 131, 132, 135, 139, 141, 150, 158, 160, 164, 165, 167, 171, 172, 174, 176, 179, 183, 185, 186, 204, 213, 218, 224, 228, 229, 232, 234, 237, 238.[41]

102. In general, the submissions oppose enabling an increase in port noise levels to avoid potential changes to amenity. Some submissions list more specific concerns. The key themes are:

(a) A concern that adoption of the Port Noise Standard is an enabler of high port noise levels. Instead, I consider the Standard provides a best practice framework for the management of port noise in response to high port noise levels (refer paragraphs 39 – 44 above).

(b) A concern that the 2018 noise monitoring used for noise model validation may be outdated. This evidence summarises recent monitoring that support the earlier findings from 2018 (refer paragraphs 27 – 28 above).

(c) Perceptions about existing port noise effects appear to be closely linked to occasional banging associated with log handling. This feedback aligns with analysis of noise complaints and the emphasis of the existing management measures Northport have in place (refer paragraphs 71 – 73 above). I consider the proposed requirement of a NMP would ensure that the best practicable option is implemented to minimise such noise effects.

(d) Concerns about noise from a drydock, previously included in Northport's 'Vision for Growth'. However, a drydock is not part of the proposed application.

[41] S42A paragraph 218 notes 46 submissions refer to terrestrial noise but does not list the relevant submission numbers. I have listed 48 submissions here. Mr Runcie lists 43 submission numbers, most align with my list here, except 191 does not seem to exist and the following submissions that do not appear to mention noise: 200, 205, 210, 214, 215, 220, 222 and 223.

COMMENT ON CONDITIONS PROPOSED BY NORTHPORT

103. I support the conditions proposed by Northport, as attached to the evidence of Mr Hood:

(a) Construction noise: The proposed conditions require measurement and assessment in accordance with NZS 6803:1999 and compliance with the permitted standard noise limits (reproduced for certainty). Further to this, I repeat my support for a CNMP recommended my Mr Runcie (refer paragraph 99 above) with some refinement to wording.

(b) Operations noise: The proposed conditions require measurement and assessment in accordance with NZS 6809:1999 and compliance with a set of noise limits in proportion to those recommended in the Port Noise Standard.

(c) Port noise mitigation: The proposed conditions require Northport to offer mitigation to dwellings exposed to port noise levels above 55 dB $L_{dn\ (5\text{-}day)}$. The mitigation would constitute an open offer to fund mechanical ventilation, cooling, and/or other mitigatory works to maintain satisfactory thermal conditions while achieving an internal design noise level of 40 dB $L_{dn\ (5\text{-}day)}$ in habitable rooms.

(d) Port Noise Management Plan: The proposed conditions require an NMP to minimise port noise effects. The NMP would be reviewed at least annually in consultation with the community.

104. I understand that my recommendations on conditions as outlined above have been incorporated into the set of updated conditions attached to Mr Hood's evidence. Insofar as they relate to terrestrial acoustics, I agree with those conditions.

Craig Fitzgerald
Marshall Day Acoustics

24 August 2023

APPENDIX A: GLOSSARY OF TERMS

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 mPa 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.
ISO 9613-2:1996	ISO Standard 9613-2:1996 "*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation*"
$L_{Aeq\ (t)}$	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.
$L_{A10\ (t)}$	The A-weighted sound level exceeded for 10% of the measurement period, measured in dB. Commonly referred to as the average maximum noise level.
$L_{A90\ (t)}$	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_{AFmax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
L_{day} or L_d	The equivalent continuous (time-averaged) A-weighted sound level (L_{Aeq}) over the daytime period (0700-2200 hours).
L_{dn}	The day night noise level which is calculated from the 24 hour L_{Aeq} with a 10 dB penalty applied to the L_{night} component.
L_{night} or L_n	The equivalent continuous (time-averaged) A-weighted sound level (L_{Aeq}) over the night-time period (2200-0700 hours).
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: PREDICTED NOISE LEVELS AT EXISTING DWELLINGS

Table 6: Existing dwellings with predicted port noise levels greater than 55 dB $L_{dn\ (5\text{-}day)}$ in 2035[42]

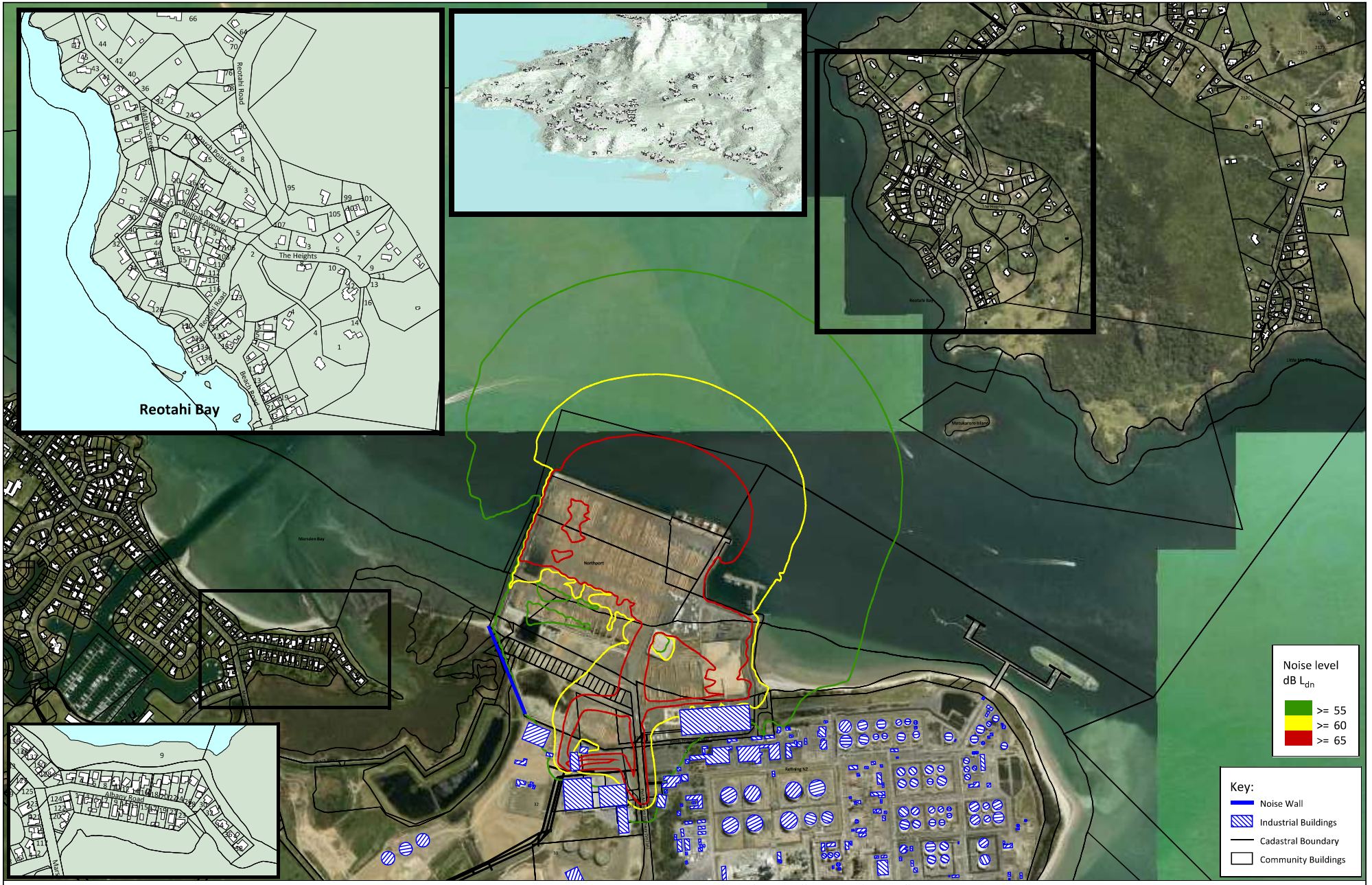
Address	Current (2022)				Future (2035)			
	24 hr	Day	Night	Night	**24Hr**	Day	Night	Night
	dB $L_{dn\ (5\text{-}day)}$	dB L_{day}	dB L_{night}	dB $L_{Aeq\ (15min)}$	**dB $L_{dn\ (5\text{-}day)}$**	dB L_{day}	dB L_{night}	dB $L_{Aeq\ (15min)}$
3 Beach Rd, Reotahi	50	43	43	44	**55**	49	49	49
9 Beach Rd, Reotahi	51	45	45	46	**57**	51	51	51
11 Beach Rd, Reotahi	51	45	45	46	**58**	51	51	52
15 Beach Rd, Reotahi	51	45	45	46	**55**	49	49	49
19 Beach Rd, Reotahi	49	43	43	44	**55**	49	49	49
21 Beach Rd, Reotahi	51	45	44	45	**56**	50	50	50
23 Beach Rd, Reotahi	51	45	45	46	**57**	51	51	51
25 Beach Rd, Reotahi	50	44	44	44	**56**	49	49	50
32 Norfolk Ave, Reotahi	51	45	44	45	**56**	49	49	50
34 Norfolk Ave, Reotahi	52	46	45	46	**57**	51	51	51
48 Norfolk Ave, Reotahi	50	44	43	44	**55**	49	49	49
123 Reotahi Rd, Reotahi	49	43	43	44	**55**	49	49	49
126 Reotahi Rd, Reotahi	52	46	46	47	**58**	51	51	52
131 Reotahi Rd, Reotahi	50	44	44	45	**56**	49	49	50
133 Reotahi Rd, Reotahi	49	43	43	44	**55**	49	49	49
134 Reotahi Rd, Reotahi	51	45	45	46	**55**	49	49	49

[42] MDA report Rp 002 R07 20200547*, 'Northport Container Terminal Expansion Noise Assessment',* 29 Sep 2022, Appendix E.

APPENDIX C: CURRENT PORT NOISE MAPS

Attached overleaf:

- Figure F-1 Current (2022) Peak 5-Day Period
- Figure F-2 Current (2022) Peak 5-Day Period
- Figure F-3 Current (2022) Peak Day
- Figure F-4 Current (2022) Peak Night
- Figure F-5 Current (2022) Peak Night 15-minute interval
- Figure F-6 Current (2022) Peak Operations Scenario



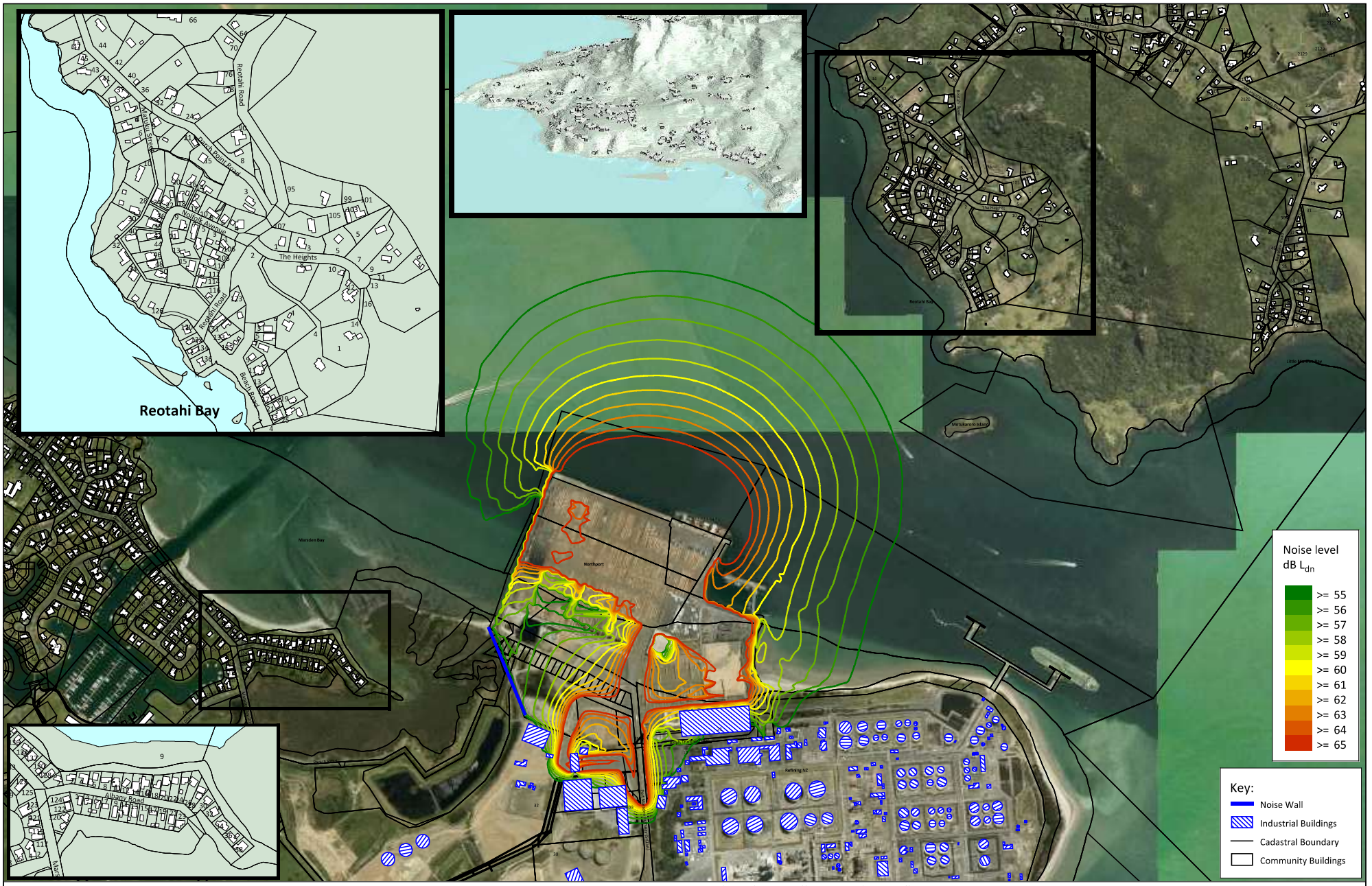
MARSHALL DAY Acoustics

Northport Noise Model
Figure F-1: Current (2022) Peak 5-day Period

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0110 & RRLK0120
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure F-1 Current 2022 LDN
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N



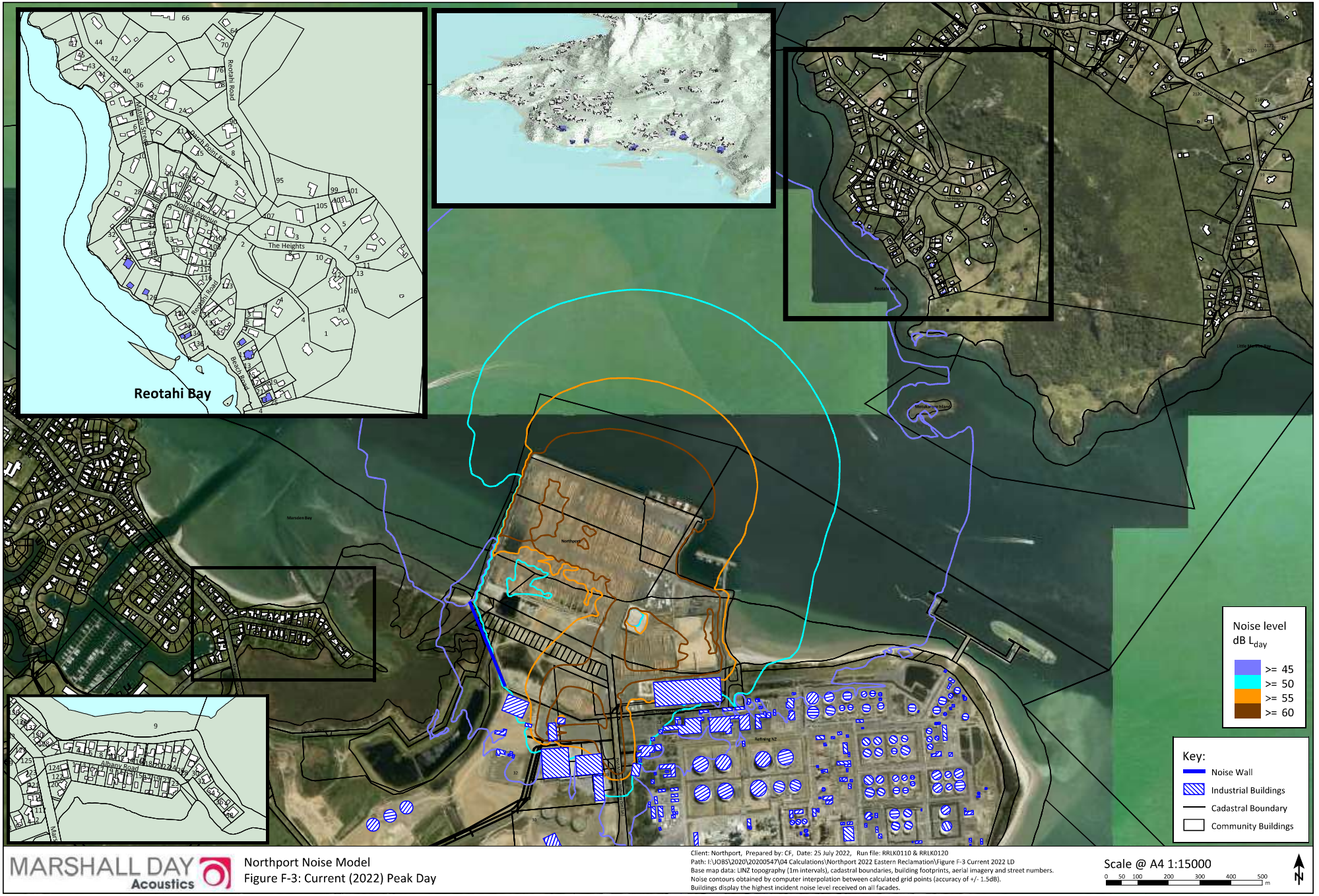
MARSHALL DAY Acoustics

Northport Noise Model
Figure F-2: Current (2022) Peak 5-day Period

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0110 & RRLK0120
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure F-2 Current 2022 LDN 1dB
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N



MARSHALL DAY Acoustics

Northport Noise Model
Figure F-3: Current (2022) Peak Day

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0110 & RRLK0120
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure F-3 Current 2022 LD
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N

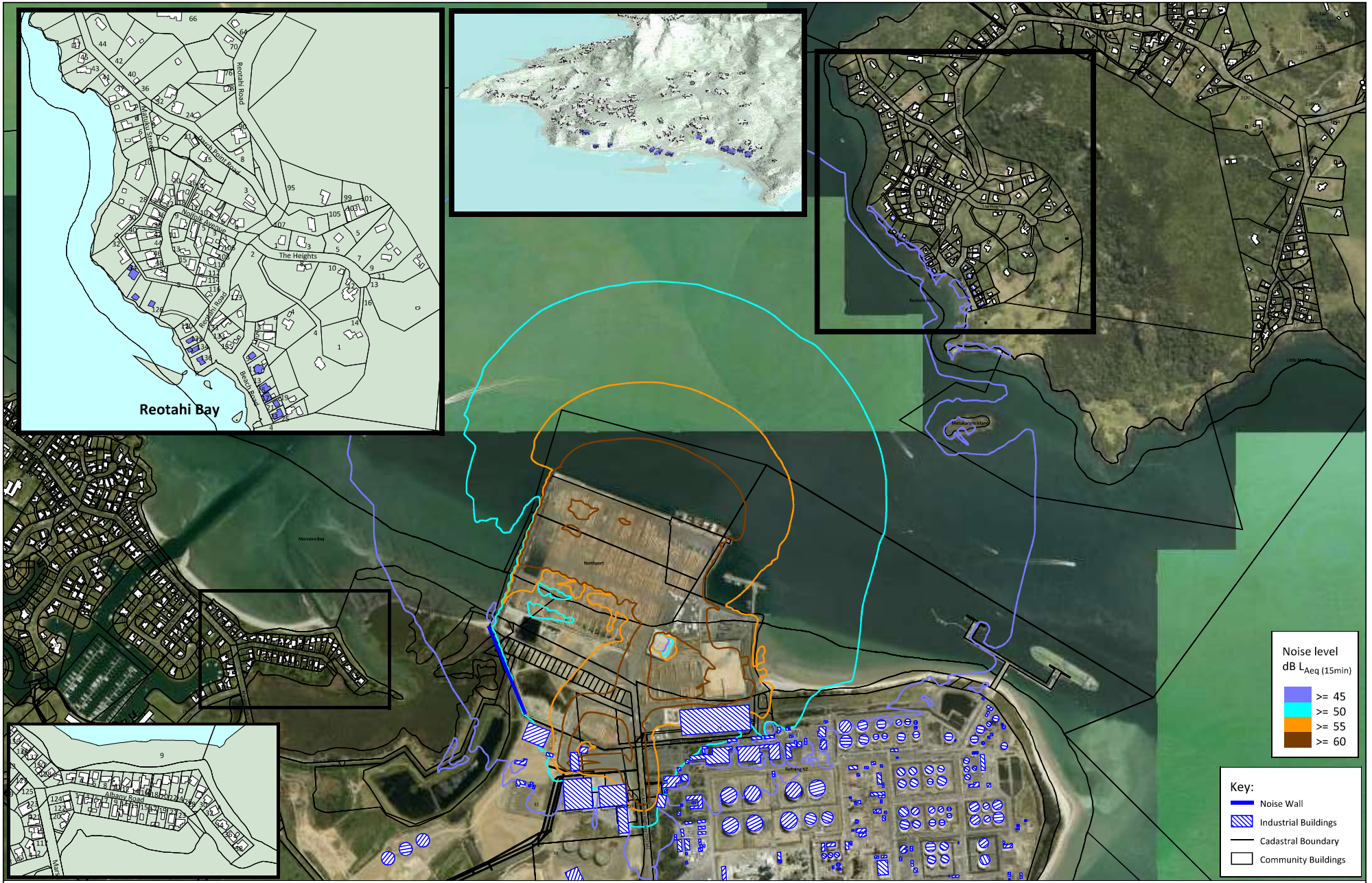
MARSHALL DAY Acoustics

Northport Noise Model
Figure F-4: Current (2022) Peak Night

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0110 & RRLK0120
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure F-4 Current 2022 LN
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N



MARSHALL DAY Acoustics

Northport Noise Model
Figure F-5: Current (2022) Peak Night 15min interval

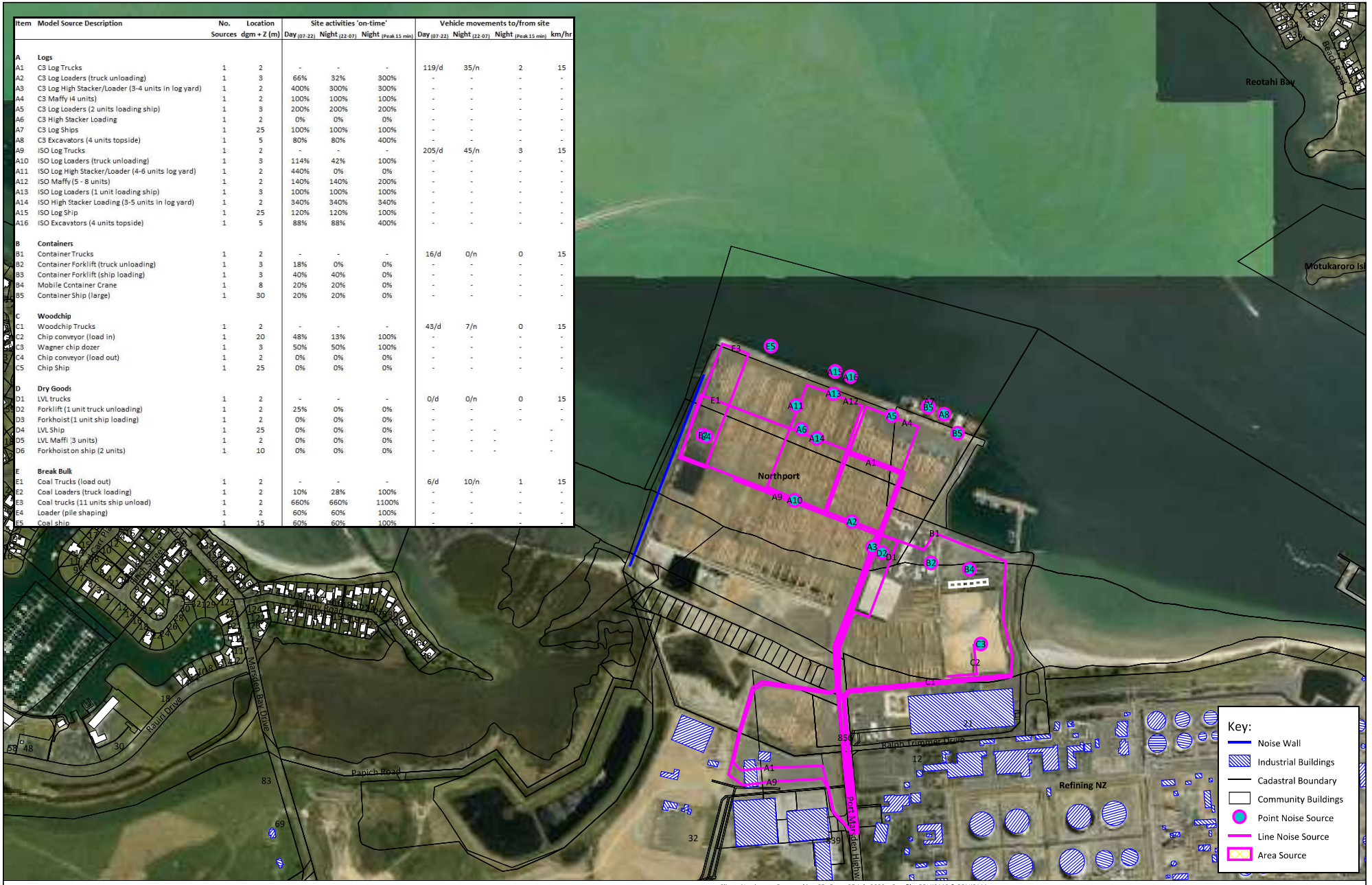
Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0111 & RRLK0121
Path: I:\JOBS\2020\2020047\04 Calculations\Northport 2022 Eastern Reclamation\Figure F-5 Current 2022 LN15
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000

0 50 100 200 300 400 500 m

N

Item	Model Source Description	No. Sources	Location dgm + Z (m)	Site activities 'on-time' Day (07-22)	Night (22-07)	Night (Peak 15 min)	Vehicle movements to/from site Day (07-22)	Night (22-07)	Night (Peak 15 min)	km/hr
A	**Logs**									
A1	C3 Log Trucks	1	2	-	-	-	119/d	35/n	2	15
A2	C3 Log Loaders (truck unloading)	1	3	66%	32%	300%	-	-	-	-
A3	C3 Log High Stacker/Loader (3-4 units in log yard)	1	2	400%	300%	300%	-	-	-	-
A4	C3 Maffy (4 units)	1	2	100%	100%	100%	-	-	-	-
A5	C3 Log Loaders (2 units loading ship)	1	3	200%	200%	200%	-	-	-	-
A6	C3 High Stacker Loading	1	2	0%	0%	0%	-	-	-	-
A7	C3 Log Ships	1	25	100%	100%	100%	-	-	-	-
A8	C3 Excavators (4 units topside)	1	5	80%	80%	400%	-	-	-	-
A9	ISO Log Trucks	1	2	-	-	-	205/d	45/n	3	15
A10	ISO Log Loaders (truck unloading)	1	3	114%	42%	100%	-	-	-	-
A11	ISO Log High Stacker/Loader (4-6 units log yard)	1	2	440%	0%	0%	-	-	-	-
A12	ISO Maffy (5 - 8 units)	1	2	140%	140%	200%	-	-	-	-
A13	ISO Log Loaders (1 unit loading ship)	1	3	100%	100%	100%	-	-	-	-
A14	ISO High Stacker Loading (3-5 units in log yard)	1	2	340%	340%	340%	-	-	-	-
A15	ISO Log Ship	1	25	120%	120%	100%	-	-	-	-
A16	ISO Excavators (4 units topside)	1	5	88%	88%	400%	-	-	-	-
B	**Containers**									
B1	Container Trucks	1	2	-	-	-	16/d	0/n	0	15
B2	Container Forklift (truck unloading)	1	3	18%	0%	0%	-	-	-	-
B3	Container Forklift (ship loading)	1	3	40%	40%	0%	-	-	-	-
B4	Mobile Container Crane	1	8	20%	20%	0%	-	-	-	-
B5	Container Ship (large)	1	30	20%	20%	0%	-	-	-	-
C	**Woodchip**									
C1	Woodchip Trucks	1	2	-	-	-	43/d	7/n	0	15
C2	Chip conveyor (load in)	1	20	48%	13%	100%	-	-	-	-
C3	Wagner chip dozer	1	3	50%	50%	100%	-	-	-	-
C4	Chip conveyor (load out)	1	2	0%	0%	0%	-	-	-	-
C5	Chip Ship	1	25	0%	0%	0%	-	-	-	-
D	**Dry Goods**									
D1	LVL trucks	1	2	-	-	-	0/d	0/n	0	15
D2	Forklift (1 unit truck unloading)	1	2	25%	0%	0%	-	-	-	-
D3	Forkhoist (1 unit ship loading)	1	2	0%	0%	0%	-	-	-	-
D4	LVL Ship	1	25	0%	0%	0%	-	-	-	-
D5	LVL Maffi (3 units)	1	2	0%	0%	0%	-	-	-	-
D6	Forkhoist on ship (2 units)	1	10	0%	0%	0%	-	-	-	-
E	**Break Bulk**									
E1	Coal Trucks (load out)	1	2	-	-	-	6/d	10/n	1	15
E2	Coal Loaders (truck loading)	1	2	10%	28%	100%	-	-	-	-
E3	Coal trucks (11 units ship unload)	1	2	660%	660%	1100%	-	-	-	-
E4	Loader (pile shaping)	1	2	60%	60%	100%	-	-	-	-
E5	Coal ship	1	15	60%	60%	100%	-	-	-	-



MARSHALL DAY Acoustics

Northport Noise Model
Figure F-6: Current (2022) Peak Operations Scenario

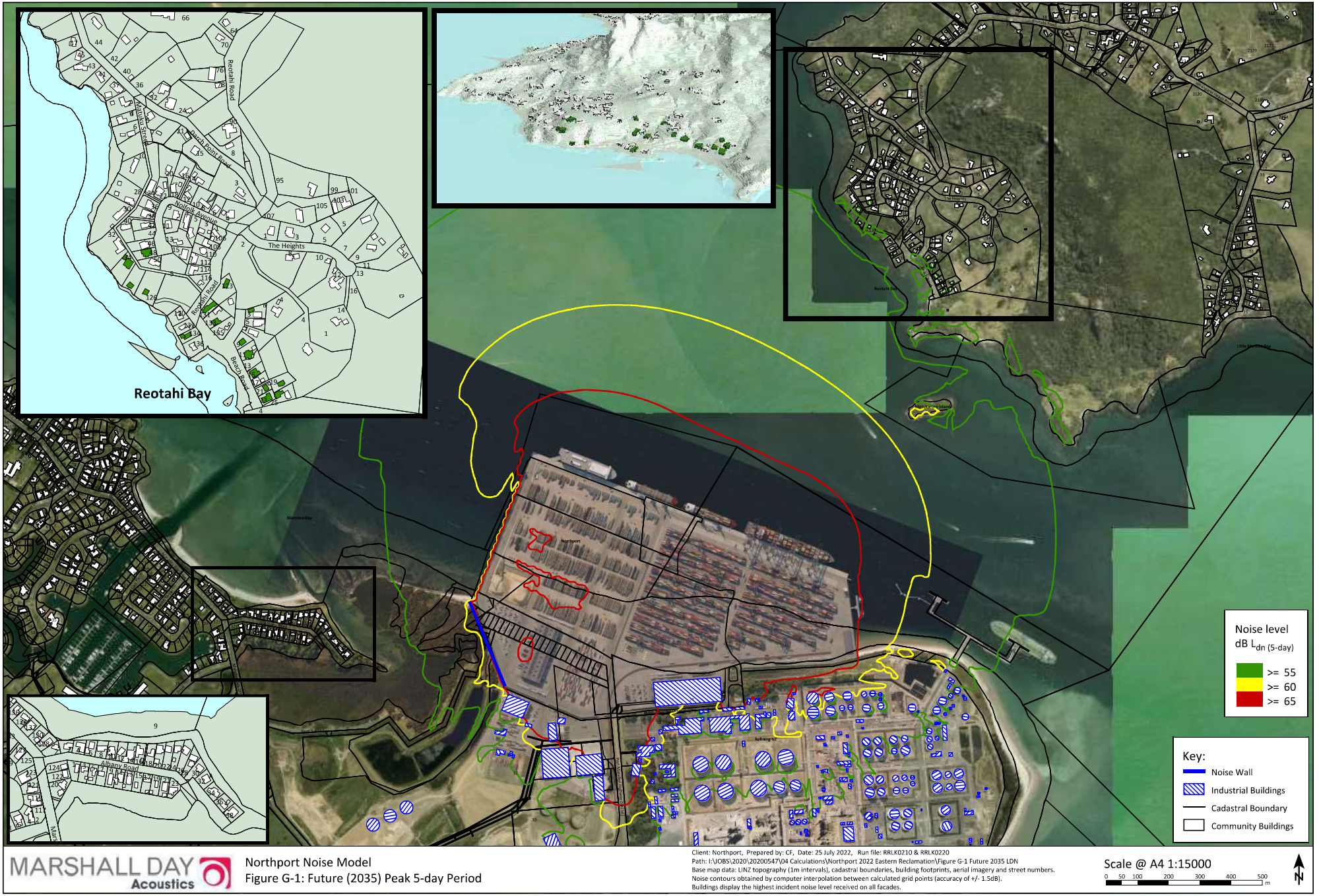
Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0110 & RRLK0111
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure F-6 Current 2022 Sources
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Operations assumptions drafted Greg Blomfield (Northport), 10 Dec 2021

Scale @ A4 1:10000
0 35 70 140 210 280 350 m
N

APPENDIX D: FUTURE PORT NOISE MAPS

Attached overleaf:

- Figure G-1 Future (2035) Peak 5-Day Period
- Figure G-2 Future (2035) Peak 5-Day Period
- Figure G-3 Future (2035) Peak Day
- Figure G-4 Future (2035) Peak Night
- Figure G-5 Future (2035) Peak Night 15-minute interval
- Figure G-6 Future (2035) Peak Operations Scenario



MARSHALL DAY Acoustics

Northport Noise Model
Figure G-1: Future (2035) Peak 5-day Period

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0210 & RRLK0220
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure G-1 Future 2035 LDN
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N

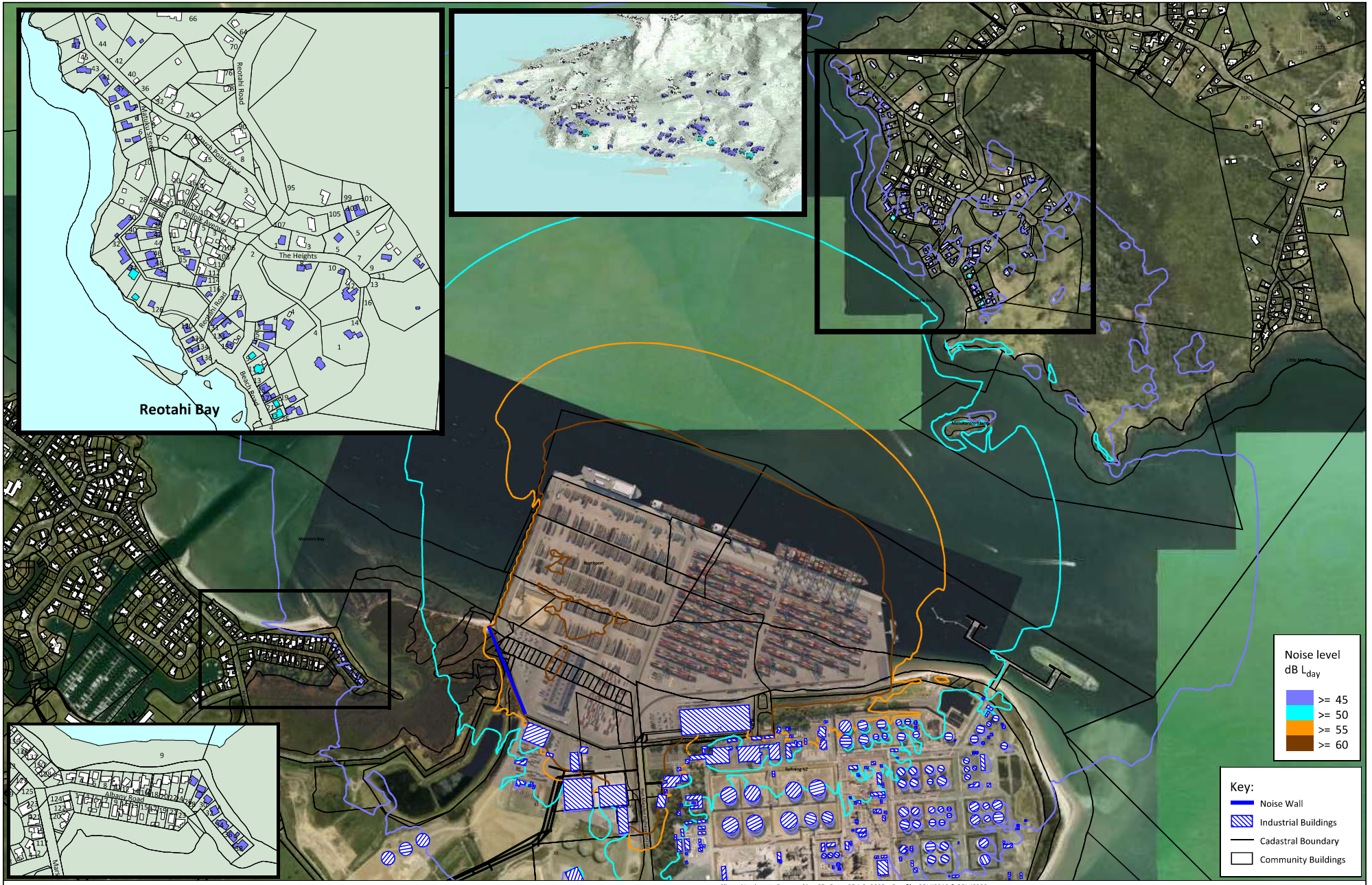
MARSHALL DAY Acoustics

Northport Noise Model
Figure G-2: Future (2035) Peak 5-day Period

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0210 & RRLK0220
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure G-2 Future 2035 LDN
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N



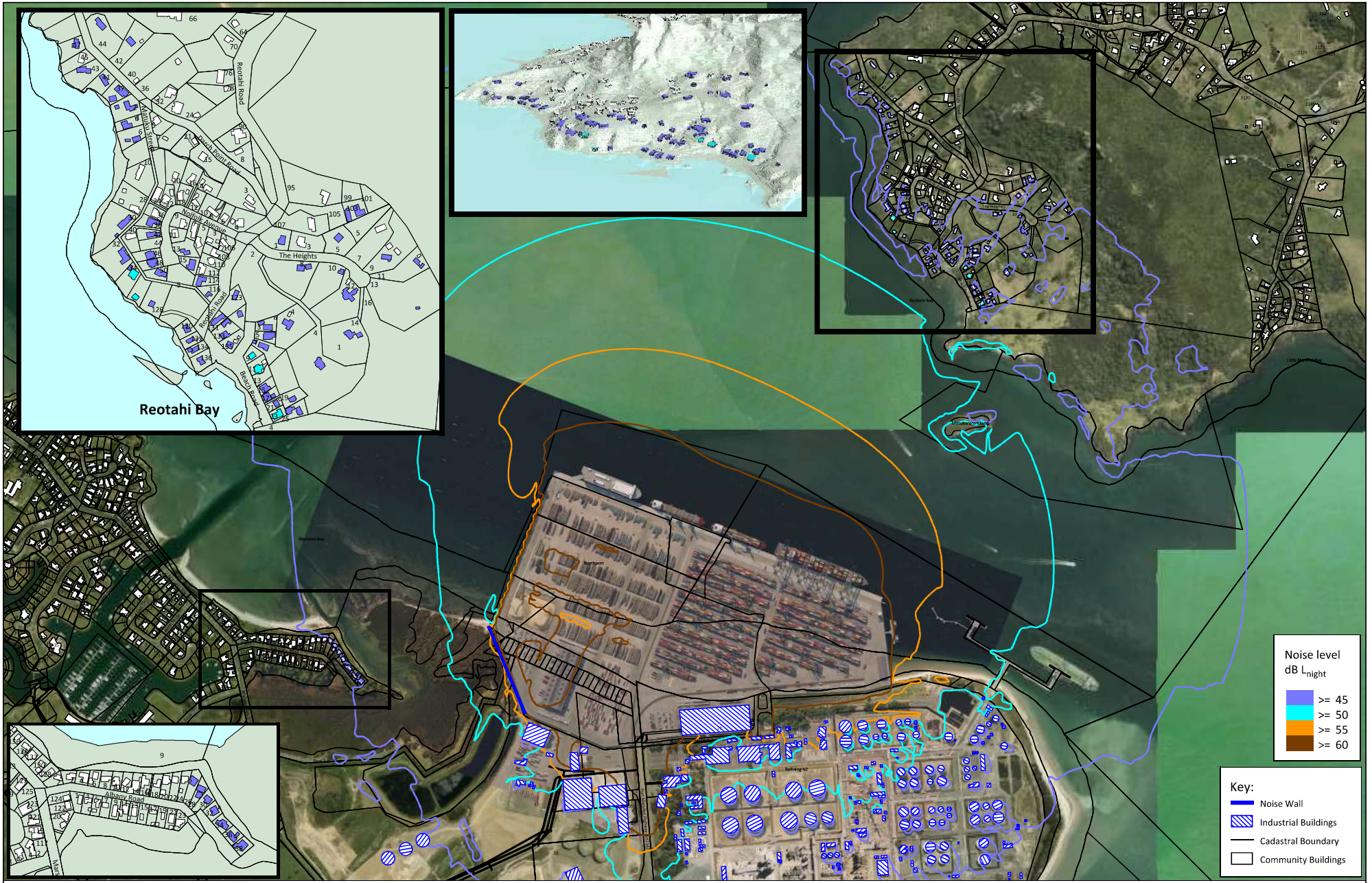
MARSHALL DAY Acoustics

Northport Noise Model
Figure G-3: Future (2035) Peak Day

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0210 & RRLK0220
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure G-3 Future 2035 LD
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N



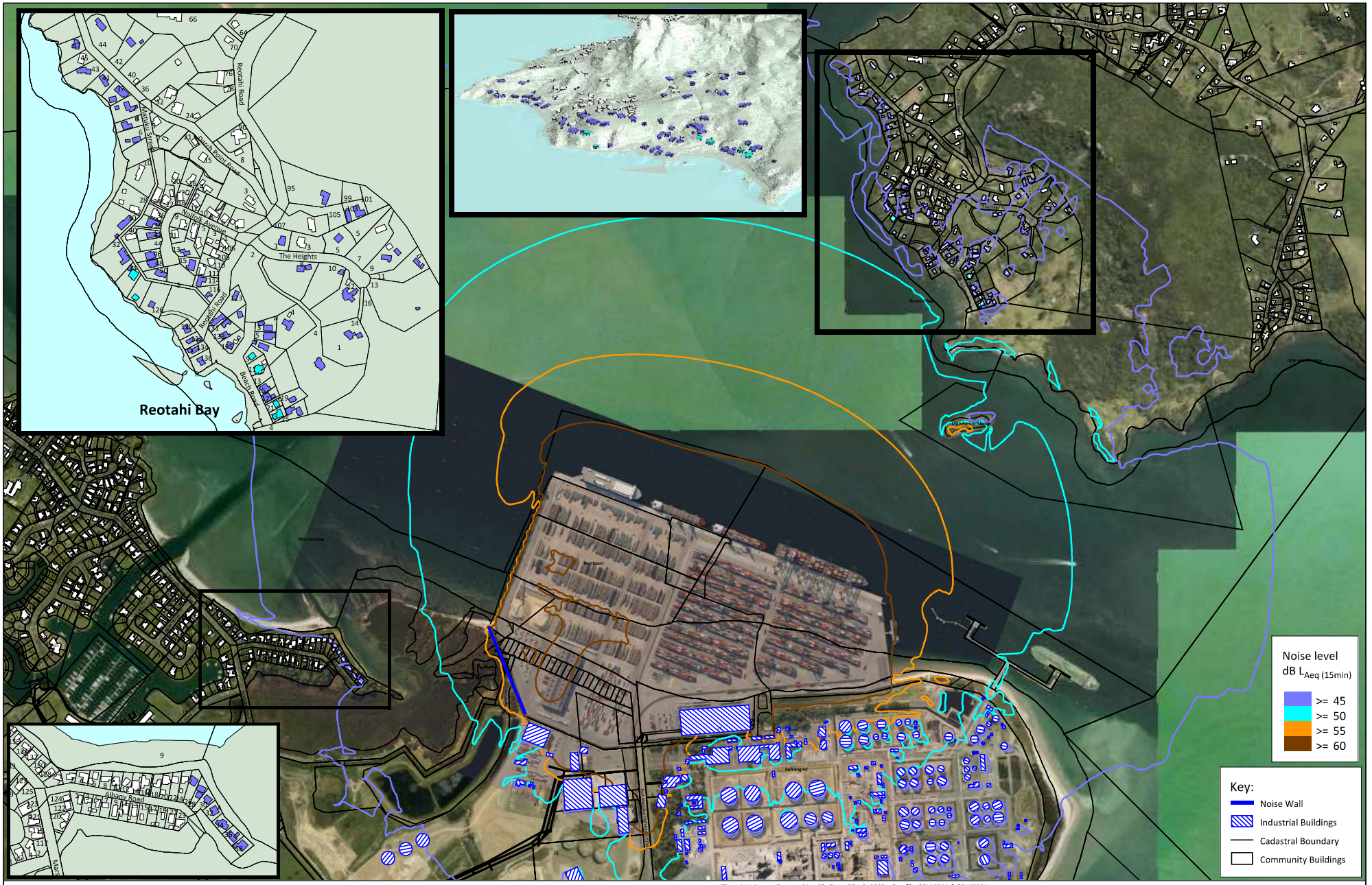
MARSHALL DAY Acoustics

Northport Noise Model
Figure G-4: Future (2035) Peak Night

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0210 & RRLK0220
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure G-4 Future 2035 LN
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N



MARSHALL DAY Acoustics

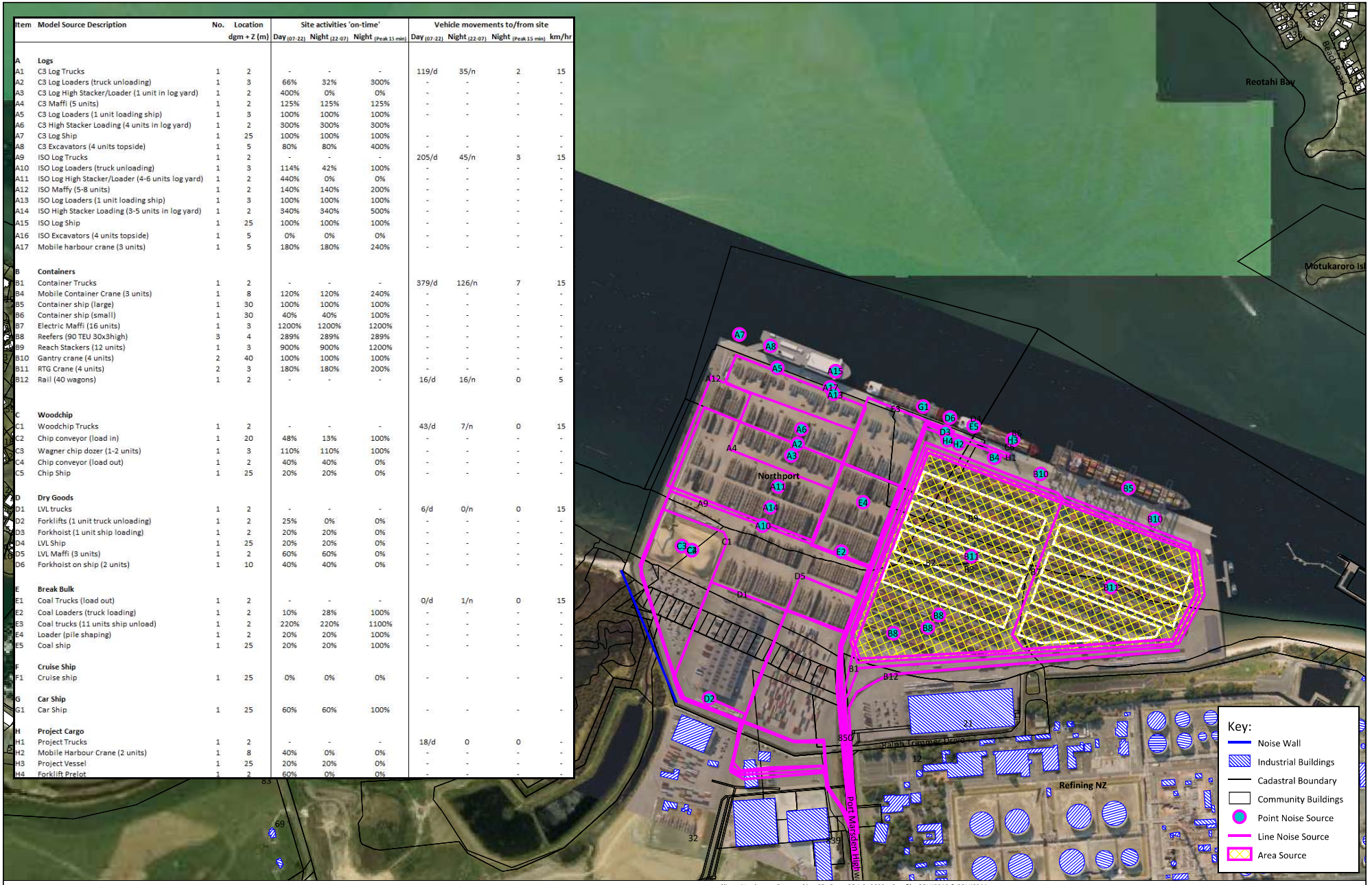
Northport Noise Model
Figure G-5: Future (2035) Peak Night 15min interval

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0211 & RRLK0221
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure G-5 Future 2035 LN15
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Noise contours obtained by computer interpolation between calculated grid points (accuracy of +/- 1.5dB).
Buildings display the highest incident noise level received on all facades.

Scale @ A4 1:15000
0 50 100 200 300 400 500 m

N

Item	Model Source Description	No.	Location dgm + Z (m)	Site activities 'on-time' Day (07-22)	Night (22-07)	Night (Peak 15 min)	Vehicle movements to/from site Day (07-22)	Night (22-07)	Night (Peak 15 min)	km/hr
A	**Logs**									
A1	C3 Log Trucks	1	2	-	-	-	119/d	35/n	2	15
A2	C3 Log Loaders (truck unloading)	1	3	66%	32%	300%	-	-	-	-
A3	C3 Log High Stacker/Loader (1 unit in log yard)	1	2	400%	0%	0%	-	-	-	-
A4	C3 Maffi (5 units)	1	2	125%	125%	125%	-	-	-	-
A5	C3 Log Loaders (1 unit loading ship)	1	3	100%	100%	100%	-	-	-	-
A6	C3 High Stacker Loading (4 units in log yard)	1	2	300%	300%	300%				
A7	C3 Log Ship	1	25	100%	100%	100%	-	-	-	-
A8	C3 Excavators (4 units topside)	1	5	80%	80%	400%	-	-	-	-
A9	ISO Log Trucks	1	2	-	-	-	205/d	45/n	3	15
A10	ISO Log Loaders (truck unloading)	1	3	114%	42%	100%	-	-	-	-
A11	ISO Log High Stacker/Loader (4-6 units log yard)	1	2	440%	0%	0%	-	-	-	-
A12	ISO Maffy (5-8 units)	1	2	140%	140%	200%	-	-	-	-
A13	ISO Log Loaders (1 unit loading ship)	1	3	100%	100%	100%	-	-	-	-
A14	ISO High Stacker Loading (3-5 units in log yard)	1	2	340%	340%	500%	-	-	-	-
A15	ISO Log Ship	1	25	100%	100%	100%	-	-	-	-
A16	ISO Excavators (4 units topside)	1	5	0%	0%	0%	-	-	-	-
A17	Mobile harbour crane (3 units)	1	5	180%	180%	240%	-	-	-	-
B	**Containers**									
B1	Container Trucks	1	2	-	-	-	379/d	126/n	7	15
B4	Mobile Container Crane (3 units)	1	8	120%	120%	240%	-	-	-	-
B5	Container ship (large)	1	30	100%	100%	100%	-	-	-	-
B6	Container ship (small)	1	30	40%	40%	100%	-	-	-	-
B7	Electric Maffi (16 units)	1	3	1200%	1200%	1200%	-	-	-	-
B8	Reefers (90 TEU 30x3high)	3	4	289%	289%	289%	-	-	-	-
B9	Reach Stackers (12 units)	1	3	900%	900%	1200%	-	-	-	-
B10	Gantry crane (4 units)	2	40	100%	100%	100%	-	-	-	-
B11	RTG Crane (4 units)	2	3	180%	180%	200%	-	-	-	-
B12	Rail (40 wagons)	1	2	-	-	-	16/d	16/n	0	5
C	**Woodchip**									
C1	Woodchip Trucks	1	2	-	-	-	43/d	7/n	0	15
C2	Chip conveyor (load in)	1	20	48%	13%	100%	-	-	-	-
C3	Wagner chip dozer (1-2 units)	1	3	110%	110%	100%	-	-	-	-
C4	Chip conveyor (load out)	1	2	40%	40%	0%	-	-	-	-
C5	Chip Ship	1	25	20%	20%	0%	-	-	-	-
D	**Dry Goods**									
D1	LVL trucks	1	2	-	-	-	6/d	0/n	0	15
D2	Forklifts (1 unit truck unloading)	1	2	25%	0%	0%	-	-	-	-
D3	Forkhoist (1 unit ship loading)	1	2	20%	20%	0%	-	-	-	-
D4	LVL Ship	1	25	20%	20%	0%	-	-	-	-
D5	LVL Maffi (3 units)	1	2	60%	60%	0%	-	-	-	-
D6	Forkhoist on ship (2 units)	1	10	40%	40%	0%	-	-	-	-
E	**Break Bulk**									
E1	Coal Trucks (load out)	1	2	-	-	-	0/d	1/n	0	15
E2	Coal Loaders (truck loading)	1	2	10%	28%	100%	-	-	-	-
E3	Coal trucks (11 units ship unload)	1	2	220%	220%	1100%	-	-	-	-
E4	Loader (pile shaping)	1	2	20%	20%	100%	-	-	-	-
E5	Coal ship	1	25	20%	20%	100%	-	-	-	-
F	**Cruise Ship**									
F1	Cruise ship	1	25	0%	0%	0%	-	-	-	-
G	**Car Ship**									
G1	Car Ship	1	25	60%	60%	100%	-	-	-	-
H	**Project Cargo**									
H1	Project Trucks	1	2	-	-	-	18/d	0	0	-
H2	Mobile Harbour Crane (2 units)	1	8	40%	0%	0%	-	-	-	-
H3	Project Vessel	1	25	20%	20%	0%	-	-	-	-
H4	Forklift Prelot	1	2	60%	0%	0%	-	-	-	-



MARSHALL DAY Acoustics

Northport Noise Model
Figure G-6: Future (2035) Peak Operations Scenario

Client: Northport, Prepared by: CF, Date: 25 July 2022, Run file: RRLK0210 & RRLK0211
Path: I:\JOBS\2020\20200547\04 Calculations\Northport 2022 Eastern Reclamation\Figure G-6 Future 2035 Sources
Base map data: LINZ topography (1m intervals), cadastral boundaries, building footprints, aerial imagery and street numbers.
Operations assumptions drafted Greg Blomfield (Northport), 10 Dec 2021

Scale @ A4 1:10000
0 35 70 140 210 280 350 m
N