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## Night-time road maintenance works Global noise consent

Assessment and management of noise effects

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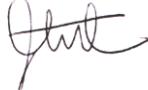
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## Executive Summary

The Nelson City Council (the Council) requires that certain sites from the annual programme of road maintenance works are delivered during the night-time period for reasons such as improved public and worker safety, enhanced efficiency of delivery, expected clashes with essential daytime network routes and some projects can be delivered more cost effectively during the night-time.

Acoustic Engineering Services Limited (AES) was engaged by the Council to undertake an assessment of effects relating to noise from the road maintenance activities. The assessment included a review of the legislative framework and relevant guidance relating to noise from road maintenance activity.

We observe that the NRMP noise rules are intended to be applied in a planning context to protect the longer-term acoustic amenity for the district and region. The delivery of short-term road maintenance works during the night-time will not cause any increase in the background noise levels experienced in those areas over the longer term.

The relevant night-time noise limits outlined in NZS6803:1999 *Acoustics – Construction Noise* would apply equally to noise associated with non-essential work which occurred all night every night, and to noise associated with essential work which only occurred occasionally. The Standard acknowledges that compliance with those limits may prevent night-time works but provides no guidance as to an appropriate approach where night-time work is unavoidable, for non-acoustic reasons.

There is a high level of variation in how programmed night-time road maintenance works are accommodated in other NZ Districts. The Christchurch and Auckland jurisdictions adopt some pragmatic approaches to this issue, where higher noise levels are permitted, provided that all practicable steps are taken to minimise noise effects. We support a similar approach in this case. It is common ground that noise levels exceeding 45 dB L<sub>Aeq</sub> at the facade of bedrooms where people are sleeping with open windows may cause sleep disturbance.

We conducted modelling for a selection of planned road maintenance project sites in the Nelson region to investigate the propagation of noise from the activities. The modelling allowed for an assessment of the typical noise effects arising from the activities and for an investigation into acceptable physical and managerial mitigation measures. The results of the noise modelling are shown in table E1.

**Table E1 - Noise modelling results**

Activity	Flat ground modelling	Average setback distance from activity to reach 45 dB L <sub>Aeq(15 min)</sub> (m)		
		Detailed modelling		
		Urban - Inner city	Urban - High density	Urban - Medium density
		174 Trafalgar Street, Nelson	653 Main Road, Stoke 20 Parkers Road, Tahunanui	5 Market Road, Bishopdale 70 Washington Road, Washington Valley 33 Dodson Road, Atawhai
Milling	500	400	400	450
Surfacing AC	500	400	350	400
Surfacing CS	500	400	350	400
Seal Cutting	1000	600	650	650
Manual Tasks	750	500	600	600
Line Marking	50	50	50	50
Sweeping	500	450	400	450

It can be seen from table E1 that noise levels are expected to be higher than 45 dB L<sub>Aeq(15min)</sub> at distances of up to 500 m from the road maintenance activities (Milling, Surfacing (AC) and Surfacing (CS), at distances of up to 1 km for Seal Cutting and other Manual Tasks. Line marking will occur some period after the road surfacing, as a separate activity. Sweeping activity will occur independent of the road maintenance and line marking activities.

To provide some context to the setback distances shown table E1, road traffic on SH6 or regional collector roads such as Waimea Road, in Nelson City, can generate noise levels in the order of 45 dB L<sub>Aeq(24 hour)</sub> at distances of 500 m from the carriageway and parts of the city could routinely experience ambient noise levels higher than 45 dB L<sub>Aeq(15min)</sub>.during the night-time.

Each site will have different circumstances that influence the effects of noise from night-time works. The above analysis demonstrates noise from the works would be higher than 45 dB L<sub>Aeq</sub> at some dwellings, during some periods. However, the effect of this noise will vary. The actual internal noise level would depend on factors such as the type of construction of the building, the layout of the building and whether the windows were open or closed. For example, a typical residential building facade with windows closed would provide at least 20 dB of noise reduction, meaning that sleep may not be disturbed until external levels exceed 55 dB L<sub>Aeq</sub>. If the bedroom is located on the opposite side of the house to the noise source, the noise levels would be lower.

The receiver catchments around some sites will have elevated existing ambient noise levels caused by the contribution of noise from transportation routes or from sources of industrial noise emission associated with the port area for example. The effects of noise on receivers in those areas may be less than for other areas in the region. There will also be receiver catchments around some sites that do not typically experience elevated levels of ambient noise, and the effects of noise from the night-time works could be greater in those areas.

The Council has indicated the activity will be undertaken at one location for a small number of nights and that site would not need to be revisited at night-time for further works inside of the current 12-month programme period. That means the effects to those receivers would be limited to a small number of nights in a year period.

We liaised with representatives of the Council and the approved contractor to facilitate the creation of a noise risk assessment and management strategy for night-time road maintenance works that will be used as a planning tool for each selected site. The upcoming night-time work will be clearly communicated to the nearest neighbours in advance, and all practical steps will be taken to limit the level and duration of the noise emissions

Appendix B contains the Noise Risk Assessment and Management Statement which should be read in conjunction with the report generally.

The results of the noise modelling are presented in graphical noise contour maps in Appendix C.

## 1.0 PROJECT OVERVIEW

The Nelson City Council (the Council) requires that certain sites from the annual programme of road works are delivered during the night-time period for reasons such as improved public and worker safety, enhanced efficiency of delivery, expected clashes with essential daytime network routes and some projects can be delivered more cost effectively during the night-time.

Acoustic Engineering Services Limited (AES) was engaged by the Council to undertake an assessment of effects relating to noise from the road maintenance activities.

The works will consist of the following activities:

- Milling
- Surfacing (Asphaltic Concrete (AC))
- Surfacing (Chip-seal (CS))
- Manual tasks (seal cutting, hydraulic breaking, plate compaction, and generator operation)
- Line-marking
- Road sweeping

The road maintenance activities will be controlled by the Council and undertaken by an approved road maintenance contractor. For milling and resurfacing works, the approved contractor would mobilise to site in the evening and the hours of operation would be 10:00 pm to 7:00 am. There will be approximately 20 sites selected for night-time works in each financial year.

Line marking will occur on every street, at least once per year as Council undertakes its annual network re-marking programme. Road sweeping will typically commence operations from 5:00 am in high use/high risk areas and continue until 10:00 pm Monday to Saturday.

We have undertaken the following scope of works:

- A review of the Nelson Resource Management Plan (NRMP), NZS 6803:1999 *Acoustics – Construction Noise* (NZS 6803), World Health Organisation (WHO) guidelines and other relevant guidance.
- Met with representatives of the Council and the approved contractor to discuss the procedures and equipment associated with the road maintenance works and investigate options for acceptable physical and managerial mitigation measures.
- Completed calculations and modelling for a selection of planned roadworks project sites in the Nelson region to investigate the propagation of noise from the activities.
- Established the typical noise effects arising from the activities.
- Liaised with representatives of the Council and the approved contractor to facilitate the creation of a noise risk assessment and management strategy for night-time road maintenance works that will be used as a planning tool for each selected site. In doing so, we develop a uniform and transparent method for planning noise mitigation whereby night-time road maintenance activities can be conducted in any planning zone without requiring an individual Resource Consent for each occurrence of work.

- Prepared a report summarising our assessment suitable for submission in support of the global consent application.

The body of this report includes an outline of the assessment methodology, the assessment of noise effects and an explanation of how a noise risk assessment and management strategy was developed and how that process will be applied.

A glossary of acoustical terminology used in this report is contained Appendix A.

Appendix B contains the Noise Risk Assessment and Management Statement which should be read in conjunction with the report generally.

The results of the noise modelling are presented in graphical noise contour maps in Appendix C.

## 2.0 GUIDANCE RELATING TO NOISE EFFECTS

The Resource Management Act (RMA) requires consideration of the significance of any adverse effects associated with the proposal. Specifically, section 104D of the RMA states that a consent authority may grant consent for a non-complying activity if it is satisfied that either the adverse effects on the environment will be minor, or that the activity is one that will be not be contrary to the objectives and policies of the relevant plan or plans.

It is also important to ensure that all practicable steps have been taken to minimise adverse effects on the environment. This concept of the Best Practicable Option (BPO) is contained, for example, in Section 16 of the RMA. The BPO, in relation to an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard to:

- The nature of the emission and the sensitivity of the receiving environment to adverse effects; and
- The financial implications, and the effects on the environment, of that option when compared with other options; and
- The current state of technical knowledge and the likelihood that the option can be successfully applied.

Other relevant guidance is discussed below.

### 2.1 Nelson Resource Management Plan

The NRMP rules that relate to noise emission depend on from where the noise originates, and on which zone the affected premises are situated. We note roads have the same zoning in the NRMP as the land that surrounds them.

The NRMP Residential Zone Rule REr.43 states:

*Noise levels generated by any non-residential activity or home occupation, measured at, or within, the boundary of any site in the Residential Zone must not exceed:*

- Daytime - L10: 55 dBA
- Other times - L10: 45 dBA, Lmax 75 dBA

*Daytime means 7:00 am to 10:00 pm Monday to Friday, and 9:00 am to 10:00 pm Saturdays, Sundays and public Holidays.*

*All measurements and assessment in accordance with NZS 6801:1991 and NZS 6802:1991.*

*Activities that contravene a permitted condition are discretionary.*

There is no explicit provision in this rule for construction noise. However, NZS 6802:1991 which is referred to in the rule states that noise associated with construction is outside the scope of that Standard. It is therefore unclear how this Rule should be interpreted for construction noise.

The NRMP Open Space and Recreational Area Zone Rule OSr.37 also contains the same noise limits as contained Residential Zone Rule REr.43.

The NRMP Inner City Zone Rule ICr.43 includes noise limits that apply for noise received in the Residential Zone, however Part C of this rule explains these limits do not apply to noise from construction activity, which when assessed at, or within, any site within the Residential Zone must comply with NZS 6803.

The NRMP Suburban Centre Zone Rule SCr.36 states:

*Noise levels generated by any non-residential activity or home occupation, measured at, or within, the boundary of any site in the Residential Zone must not exceed:*

- Daytime - L10: 65 dBA
- Other times - L10: 45 dBA, Lmax 75 dBA

*Daytime means 7:00 am to 10:00 pm Monday to Friday, and 9:00 am to 10:00 pm Saturdays, Sundays and public Holidays.*

*All measurements and assessment in accordance with NZS 6801:1991 and NZS 6802:1991.*

*Activities that contravene a permitted condition are discretionary.*

The NRMP Suburban Centre Zone Rule SCr.37 includes noise limits that apply for noise received in the Residential Zone, however Part C of this rule explains these limits do not apply to noise from building and demolition activity, which when assessed at, or within, any site within the Residential Zone must comply with NZS 6803P:1984 Acoustic – Construction noise. We note this standard has been superseded by NZS 6803.

The relevant NRMP rules are therefore inconsistent in their approach to construction noise. In some zones it appears construction noise falls to be considered under the general noise limits, while in others there is some reference to NZS 6803.

## 2.2 NZS 6803

NZS 6803 recommends upper limits for construction noise. These limits depend on the time of day and day of the week, reflecting different sensitivities particularly at night-time. The daytime limits are also adjusted based on the planned duration of the construction works. For projects that are expected to last for less than 14 days at any one location, the standard recommends daytime noise limits that are less stringent than for longer term works. The noise limits for short-term works are reproduced in table 2.1.

The limits are provided in terms of a time average level ( $L_{Aeq}$ ) and a maximum instantaneous level ( $L_{AFmax}$ ). Given the nature of the planned activities, it is appropriate to apply a 15-minute time averaging interval to the relevant  $L_{Aeq}$  limits.

**Table 2.1 – Construction noise limits**

Building type	Days	Times	Recommended upper limits dB	
			$L_{Aeq}(15\text{ min})$	$L_{AFmax}$
Residential	Weekdays	6:30 am – 7:30 am	65	75
		7:30 am – 6:00 pm	80	95
		6:00 pm – 8:00 pm	75	90
		8:00 pm – 6:30 am	45	75
	Saturdays	6:30 am – 7:30 am	45	75
		7:30 am – 6:00 pm	80	95
		6:00 pm – 8:00 pm	45	75
		8:00 pm – 6:30 am	45	75
Industrial and commercial	Sundays and public holidays	6:30 am – 7:30 am	45	75
		7:30 am – 6:00 pm	55	85
		6:00 pm – 8:00 pm	45	75
		8:00 pm – 6:30 am	45	75
	All days	7:30 am – 6:00 pm	80	-
		6:00 pm – 7:30 am	85	-

As shown in table 2.1, during the period from 10:00 pm to 7:00 am which is relevant for this Consent, the noise limit is typically 45 dB  $L_{Aeq}$  / 75 dB  $L_{AFmax}$ . Section C7.2.5 of NZS 6803 states that “noise limits ( $L_{eq}$ ) of... ... 45 dBA at night-time may mean that no construction work can take place”. NZS 6803 provides no further guidance on an appropriate approach where undertaking work at night-time is unavoidable. We note that under the Standard, the above noise limits would apply equally to noise associated with non-essential work which occurred all night every night, and to noise associated with essential work which only occurred occasionally.

## 2.3 The management of night-time road maintenance works in other NZ jurisdictions

There is a high level of variation in how programmed night-time road maintenance works are accommodated in other NZ Districts. We have provided two examples below.

### 2.3.1 Christchurch District

A rule in the Transport section of the Christchurch District Plan (CDP) (Section 7.4.2.1 P12) that lists the following as a Permitted Activity “The operation or maintenance of transport infrastructure (including ancillary offices and car parking areas) and freight handling activities in the Transport Zone.” However, Section 6.1.6.1.1 P2 of the CDP also states that “Construction activities shall meet relevant noise limits in Tables 2 and 3 of NZS 6803, when measured and assessed in accordance with that standard.”

We understand that overall the Christchurch City Council takes the view that the CDP requires night-time road maintenance works to comply with the noise limits set out in NZS6803. They are also aware that few night-time activities can practically comply with those rules. However, those activities are not required to seek a Resource Consent. Smaller scale works are often undertaken with no formal process relating to noise

management. Those planning larger scale works are encouraged to adopt a Noise Management Plan – and the Council has found this to generally be successful in minimising complaints.

### **2.3.2 Auckland District**

There are activity specific rules in the operative Auckland Unitary Plan relevant to noise from night-time road maintenance works within the road between 10:00 pm and 7:00 am.

AUP Section E25.6.29 *Construction noise and vibration levels for work within the road* can be summarised as follows:

- Exceedance of the NZS6803 night-time noise limits is allowable if night-time works last for three nights or less, and;
- the works cannot be practicably carried out during the day or because the road controlling authority requires this work to be done at night-time, or;
- because of the nature of the works the noise produced cannot be practicably made to comply with the relevant noise levels.

In addition, a Noise Management Plan (NMP) must be submitted at least five days prior to commencement of the night-time works.

### **2.4 World Health Organisation**

*Guidelines for Community Noise*<sup>1</sup>, a document produced by the WHO based on extensive international research recommends a guideline night-time limit of 45 dB L<sub>Aeq</sub> to allow occupants to sleep with windows open.

### **2.5 Discussion regarding appropriate approach to noise management**

We observe that the NRMP noise rules are intended to be applied in a planning context to protect the longer-term acoustic amenity for the district and region. The delivery of short-term road maintenance works during the night-time will not cause any increase in the background noise levels experienced in those areas over the longer term.

Similarly, the night-time noise limits outlined in NZS6803 would apply equally to noise associated with non-essential work which occurred all night every night, and to noise associated with essential work which only occurred occasionally. The Standard acknowledges that compliance with those limits may prevent night-time works but provides no guidance as to an appropriate approach where night-time work is unavoidable, for non-acoustic reasons.

It is common ground that noise levels exceeding 45 dB L<sub>Aeq</sub> at the facade of bedrooms where people are sleeping with open windows may cause sleep disturbance. The Christchurch and Auckland examples described above illustrate some pragmatic approaches to this issue, where higher noise levels are permitted, provided that all practicable steps are taken to minimise noise effects. We support a similar approach in this case.

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<sup>1</sup> Edited by Berglund, B et al. *Guidelines for community noise*. World Health Organization 1999.

### 3.0 THE COLLABORATIVE APPROACH

As described above, night-time works present a challenge from a noise perspective. Having determined that work at some sites will need to be undertaken during the night-time, the Council has undertaken steps to develop a robust approach to manage noise from the works including:

- The Council has reviewed the current good practice guidance for managing noise from construction activity that needs to be undertaken outside of standard daytime hours. The study included a review of national and international standards.
- The Council has engaged AES, a specialist acoustic engineering consultancy, to provide guidance on noise management best practice.
- We have undertaken noise modelling to investigate the effects associated with the planned night-time works. The investigation included 3D software modelling and detailed assessment based on the actual plant that will be utilised during the different road work activities. The modelling has been used to investigate the propagation of noise from the works and to determine expected noise levels at various distances.
- The approved contractor has been involved in discussions since the beginning of the planning process. They have offered insights into site practices, input into practicable mechanical noise control options and assisted with the formulation of site-based noise management processes.
- The Council, in collaboration with the approved contractor and AES, have developed a risk assessment method that Council and the contractor will use to determine the level of risk for specific sites and allow for noise mitigation planning for each individual site. Noise mitigation will be provided for all programmed night-time road work sites. The risk assessment tool is explained further in section 5.0.
- The Council has an existing system for community consultation. The existing system has been used as the basis for a project specific community consultation process relating to the planned night-time works.
- The Council has undertaken a review of the planning approaches used in other jurisdictions for controlling the effects of noise from night-time road maintenance works.

The outcomes of this work are outlined in this report.

#### **4.0 NOISE MODELLING**

To investigate the propagation of noise from the activities, a SoundPLAN (v8.1) environmental computer model was developed. SoundPLAN is a software package which enables compilation of a sophisticated 3D computer model comprising a digitised ground map based in the local topography, the locations of the critical noise sources on site and includes the surrounding buildings which can provide screening and reflection of noise.

The SoundPLAN model can generate noise level contours accounting for such factors as the source sound power levels, distance attenuation, ground absorption, air absorption, shielding attenuation as well as meteorological conditions. The meteorological settings of the model included a slightly positive propagation from source to receiver to provide an overall “worst-case” assessment outcome. The predicted noise levels included a +3 dB correction to account for reflection from the facade of a receiver building as the noise limits apply at 1 m from the building facades.

The resulting noise level contours for each activity at each of the planned sites were used to determine the distance from each activity where noise levels have reduced to  $45 L_{Aeq(15\ min)}$ .

##### **4.1 Activities and noise sources**

The road works activities were modelled based on the equipment details and fleet compositions shown in table 4.1.

**Table 4.1 – Modelled activities**

Activity	Equipment	Quantity	Details (Make, model, size, if known)	Sound Power Level of each source dB L <sub>WA</sub>
Milling	Profiler	1	Wirtgen – W150	110
	Truck - tipper	3	Hino -700 FS2844	103
	Broom	1	Kubota – B3030	95
Surfacing (AC)	Asphalt paver	1	Bitelli – BB730	106
	Truck - tipper	3	Hino -700 FS2844	103
	Vibratory roller	1	CAT – 150C PTR or Bomag BW120AD - 4t or Saikai SW652 - 7t	107
	Broom	1	Kubota – B3030	95
	Bobcat	1	CAT 272D	97
Surfacing (CS)	Spray truck	1	Hino – GH 1991	106
	Chip spreader	1	Penny Engineering – Fitted to Hino 700	108
	Truck - tipper	3	Hino -700 FS2844	103
	Broom	1	Kubota – B3030	95
Manual tasks	Seal cutting saw	1	Loncin – 200mm cut floor saw	121
	Plate compactor	1	Mikasa – 60kg	103
	Pedestrian roller	1	Wacker RS800	107
	Hydraulic breaker	1	Makita	115
	Generator	1	Subaru – 3.5 kVA	100
Line marking	Line marking machine	1	-	85
Sweeping	Road sweeper	1	Stock with JCB power unit	112

To provide some context to the noise emission from the plant items listed in table 4.1, the sound power levels for the equipment are what could be expected from typical equipment used throughout the region for roadworks, construction and demolition projects.

We note that the noise emission from the manual seal cutting saw is expected to be significantly higher than for the other plant items while in use. We understand this saw would only be used for short periods during the shift and there be the potential to schedule the use for the earliest part of the shift to mitigate the noise effects. The noise from the hydraulic breaker is also expected to be higher than the other noise sources on site. Further discussion of noise mitigation for these louder manual type tasks is included in Appendix B.

The activities were modelled based on our understanding of the current equipment fleets for each activity, and we note this may change slightly over time. The activities were modelled using two different model environments:

- Actual project site locations – Six actual project site locations were selected from the 2020 programme to include in the modelling. The sites differed in that the density of buildings surrounding the sites varied.

- Flat ground – Generic model settings to assess the worst-case noise propagation where no screening from existing buildings or terrain is included.

The actual site locations varied in terms of the type and density of nearby buildings. Noise modelling was undertaken for each of the activities at the following actual site locations:

- 174 Trafalgar Street, Nelson

Located in the Nelson City Central Business District and surrounded by multilevel commercial buildings.

- 653 Main Road, Stoke

Located in suburban Nelson and surrounded by a mix of residential and commercial buildings and only small areas of open space.

- 20 Parkers Road, Tahunanui

Located in suburban Nelson and surrounded by a mix of residential and commercial buildings and only small areas of open space.

- 5 Market Road, Bishopdale

Located in suburban Nelson and surrounded by a mix of residential and commercial buildings, with a large open space area to the south.

- 70 Washington Road, Washington Valley

Located in suburban Nelson and surrounded by residential buildings, with open space areas to the east, south and west.

- 33 Dodson Road, Atawhai

Located in suburban Nelson and surrounded by residential buildings, with the ocean to the east and a large open space area to the west.

To investigate the effect of noise propagation depending on the type of site, we grouped the locations and averaged the modelling results as shown in table 4.2.

Noise contours maps for each activity at each of the modelled locations are shown in Appendix C.

## 4.2 Noise modelling results

The results of the noise modelling were used to investigate the propagation of noise from the activities and to determine the average setback distances from each activity that would be required for the noise to reach 45 L<sub>Aeq(15 min)</sub>, as shown in table 4.2.

**Table 4.2 - Noise modelling results**

Activity	Flat ground modelling	Average setback distance from activity to reach 45 dB L <sub>Aeq(15 min)</sub> (m)		
		Detailed modelling		
		Urban - Inner city	Urban - High density	Urban - Medium density
		174 Trafalgar Street, Nelson	653 Main Road, Stoke 20 Parkers Road, Tahunanui	5 Market Road, Bishopdale 70 Washington Road, Washington Valley 33 Dodson Road, Atawhai
Milling	500	400	400	450
Surfacing AC	500	400	350	400
Surfacing CS	500	400	350	400
Seal Cutting	1000	600	650	650
Manual Tasks	750	500	600	600
Line Marking	50	50	50	50
Sweeping	500	450	400	450

It can be seen from table 4.2 that noise levels are expected to be higher than 45 dB L<sub>Aeq(15min)</sub> at distances of up to 500 m from the road maintenance activities (Milling, Surfacing (AC) and Surfacing (CS), at distances of up to 1 km for Seal Cutting and other Manual Tasks. Line marking will occur some period after the road surfacing, as a separate activity. Sweeping activity will occur independent of the road maintenance and line marking activities.

To provide some context to the setback distances shown table 4.2, road traffic on SH6 or regional collector roads such as Waimea Road, in Nelson City, can generate noise levels in the order of 45 dB L<sub>Aeq(24 hour)</sub> at distances of 500 m from the carriageway and parts of the city could routinely experience ambient noise levels higher than 45 dB L<sub>Aeq(15min)</sub> during the night-time.

We note the night-time limit in NZS 6803 (45 dB L<sub>Aeq(15 min)</sub>) is approximately 2 dB lower than the current NRMP noise limit for residential areas (45 dB L<sub>10</sub>). The offset distances to achieve the NRMP planning noise limits would be larger than those shown in table 4.2.

## 5.0 NOISE MANAGEMENT AND MITIGATION MEASURES

To minimise the potential adverse effects of the noise described in the previous section, a method has been developed for assessing the risk from noise for each site and planning for mitigation of noise, with the aim to maximise the reduction of noise from the works using physical and managerial measures that can be practicably applied on site.

To evaluate the level of “noise risk” for a specific site, a risk assessment tool has been prepared for use by Council during the planning and programming of the work. This risk assessment process is intended to be applied only after the Council decision that a certain site from the annual programme of road maintenance works is to be selected for delivery during the night-time period. Recording details of the decision to undertake the work at night-time is beyond the scope of this document but reasons for that decision may include issues such as opportunities for improved public and worker safety, expectations of enhanced efficiency of delivery, avoiding expected clashes with essential daytime network routes, and some projects can be delivered more cost effectively during the night-time.

The noise risk assessment tool provides a transparent and uniform method for the early consideration of noise during the planning stages. The document was developed in collaboration with the Council and the approved contractor, and included guidance on best practice from the following sources:

- NZS 6803
- London Good Practice Guide: *Noise and vibration for demolition and construction*, July 2016
- British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites Part 1: Noise*

The risk assessment document, in template format, is shown in Appendix B. The document will be completed with cooperation between the Council and the approved contractor during planning for the work. The process consists of the following tasks:

- Determine the site noise risk level rating.

The level of noise risk for a site depends on factors such as the existing levels of ambient noise, the type and density of the receiver catchment, the planned duration of the work and other possibly known risk elevators such as a history of complaints or the presence of high sensitivity spaces adjacent to the work area.

- Identify noise mitigation measures.

A minimum level of noise mitigation will be provided for all programmed night-time road work sites. There are additional noise mitigation measures that should be considered for sites determined to be a “higher noise risk site”.

- Acceptance and implementation of mitigation measures.

A record will be kept of acceptance, by the persons in control of the site, of the selected mitigation measures and that all the necessary consultation and communication has taken place prior to commencement of work.

The completed document will be distributed to the approved contractor representatives undertaking the works and to the Council Monitoring Team at least thirty days prior to the commencement of the works. The completed documentation will become a part of the overall management plan for work at that specific site and provide noise management guidance for the people in control of the site during the time allocated in the document.

Prior to commencing the work, the Council will notify residents within the setback distances shown in table 4.2 by means including social media, website information and variable message boards located at the work site. In the event of receiving a noise complaint relating to the works, the established Council management processes will be utilised.

## 6.0 ASSESSMENT OF NOISE EFFECTS

Each site will have different circumstances that influence the effects of noise from night-time works.

As the above analysis demonstrates, noise from the works would be higher than 45 dB L<sub>Aeq</sub> at some dwellings, during some periods. However, the effect of this noise will vary. The actual internal noise level would depend on factors such as the type of construction of the building, the layout of the building and whether the windows were open or closed. For example, a typical residential building facade with windows closed would provide at least 20 dB of noise reduction, meaning that sleep may not be disturbed until external levels exceed 55 dB L<sub>Aeq</sub>. If the bedroom is located on the opposite side of the house to the noise source, the levels would be lower.

The receiver catchments around some sites will have elevated existing ambient noise levels caused by the contribution of noise from transportation routes or from sources of industrial noise emission associated with the port area for example. The effects of noise on receivers in those areas may be lower than for other areas in the region. There will also be receiver catchments around some sites that do not typically experience elevated levels of ambient noise, and the effects of noise from the night-time works could be greater in those areas.

The Council has indicated the activity will be undertaken at one location for a small number of nights and that site would not need to be revisited at night-time for further works inside of the current 12-month programme period. That means the effects to those receivers would be limited to a small number of nights in a year period. As above, the upcoming night-time work will be clearly communicated to the nearest neighbours in advance, and all practical steps will be taken to limit the level and duration of the noise emissions.

## 7.0 CONCLUSION

Acoustic Engineering Services Limited (AES) was engaged by the Council to undertake an assessment of effects relating to noise from road maintenance that would be undertaken during the night-time.

The assessment included a review of relevant legislation and other guidance around the issue of managing noise from construction type activities during the night-time. It was recommended that the noise effects from the short-term roadwork maintenance activities be assessed in consideration of the guidance provided by the current version of NZS 6803.

Detailed noise modelling was undertaken to investigate the propagation of noise from the works at a series of example sites that require road maintenance according to the current programme.

The modelling has shown that noise levels are expected to be higher than the controlling NZS 6803 noise limit (45 dB L<sub>Aeq(15min)</sub>) at setback distances of up to 500 m from the main activities (Milling, Surfacing (AC) and Surfacing (CS), and at distances of up to 1 km for Seal Cutting and other Manual Tasks.

The modelling demonstrated that noise from the works would be higher than 45 dB L<sub>Aeq</sub> at some dwellings, during some periods. However, the effect of this noise will vary. The actual internal noise level would depend on factors such as the type of construction of the building, the layout of the building and whether the windows were open or closed. For example, a typical residential building facade with windows closed would provide at least 20 dB of noise reduction, meaning that sleep may not be disturbed until external levels exceed 55 dB L<sub>Aeq</sub>. If the bedroom is located on the opposite side of the house to the noise source, the levels would be lower.

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The Council has indicated the activities will be undertaken at one location for a small number of nights and that site would not need to be revisited at night-time for further works inside of the current 12-month programme period. That means the effects to those receivers would be limited to a small number of nights in a year period. As above, the upcoming night-time work will be clearly communicated to the nearest neighbours in advance, and all practical steps will be taken to limit the level and duration of the noise emissions.

To minimise the potential adverse effects of the noise, a method has been developed for assessing the risk from noise for each site and planning for mitigation of noise, with the aim to maximise the reduction of noise from the works using physical and managerial measures that can be practicably applied on site.

The completed document will be distributed to the approved contractor representatives undertaking the works and to the Council Monitoring Team at least thirty days prior to the commencement of the works. The completed documentation will become a part of the overall management plan for work at that specific site and provide noise management guidance for the people in control of the site during the time allocated in the document.

## 8.0 REFERENCES

- New Zealand Standard NZS 6803:1999 *Acoustics – Construction noise*
- Christchurch District Plan,  
<https://districtplan.ccc.govt.nz/pages/plan/book.aspx?exhibit=DistrictPlan>, viewed 20 April 2020.
- Auckland Unitary Plan Operative in part,  
[https://unitaryplan.aucklandcouncil.govt.nz/pages/plan/Book.aspx?exhibit=AucklandUnitaryPlan\\_Print](https://unitaryplan.aucklandcouncil.govt.nz/pages/plan/Book.aspx?exhibit=AucklandUnitaryPlan_Print), viewed 20 April 2020.
- London Good Practice Guide: *Noise and vibration for demolition and construction*, July 2016
- British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites Part 1: Noise*

## Appendix A

### Glossary of acoustics terminology

Ambient sound level	The total sound level that includes contribution from all sources of noise present in the testing environment.																
Decibel [dB]	<p>The measured sound pressure level is typically presented in the units of Decibels. Some typical sound pressure levels include:</p> <table> <tbody> <tr> <td>30 dB(A)</td> <td>A quiet library or a quiet outdoor location in the country.</td> </tr> <tr> <td>45 dB(A)</td> <td>Typical office space or outdoor in a city at night.</td> </tr> <tr> <td>60 dB(A)</td> <td>Outdoors in a city centre during the daytime.</td> </tr> <tr> <td>70 dB(A)</td> <td>A car passing by on the street.</td> </tr> <tr> <td>80 dB(A)</td> <td>Loud music played inside a home.</td> </tr> <tr> <td>90 dB(A)</td> <td>A truck passing on the street.</td> </tr> <tr> <td>100 dB(A)</td> <td>A loud music concert.</td> </tr> <tr> <td>120 dB(A)</td> <td>Very loud noise, possibly causing discomfort.</td> </tr> </tbody> </table>	30 dB(A)	A quiet library or a quiet outdoor location in the country.	45 dB(A)	Typical office space or outdoor in a city at night.	60 dB(A)	Outdoors in a city centre during the daytime.	70 dB(A)	A car passing by on the street.	80 dB(A)	Loud music played inside a home.	90 dB(A)	A truck passing on the street.	100 dB(A)	A loud music concert.	120 dB(A)	Very loud noise, possibly causing discomfort.
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90 dB(A)	A truck passing on the street.																
100 dB(A)	A loud music concert.																
120 dB(A)	Very loud noise, possibly causing discomfort.																
dB(A)	<p>A-weighted decibels.</p> <p>The human ear is more sensitive to mid frequency sounds.</p> <p>Low and high frequency sounds of the same loudness are not perceived as being as loud.</p> <p>A sound level meter measures all frequencies equally but can then aim to replicate the human response of the ear by using an electronic filter which is called an “A” weighting filter.</p> <p>The sound pressure level in dB(A) gives a closer indication of the subjective loudness of a noise.</p>																
$L_{Amax(T)}$	The maximum sound pressure level measured over a given period.																
$L_{Aeq(T)}$	The “equivalent noise level” is the summation of noise events and integrated over a specific period of time (T). Sometimes called the average noise level.																

## Appendix B

### Noise risk assessment and management statement template



Nelson City Council  
Transport Operations

## Programmed night-time road maintenance works

## Noise risk assessment and management statement

Site address		
Expected work start date		
Expected duration of work		
Planned activity	Milling <input type="checkbox"/> Asphalt surfacing (AC) <input type="checkbox"/> Asphalt surfacing (Chip seal) <input type="checkbox"/> Line marking <input type="checkbox"/> Road sweeping <input type="checkbox"/>	Details/Comments (if required)
Noise risk assessment date		
Contractor representative (see Section 5 for contact details)		
Council representative (see Section 5 for contact details)		

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## 1.0 PROCESS OVERVIEW

Nelson City Council (the Council) will implement a programme of essential road maintenance activity across the district. Some of the work at certain sites may be identified as needing to be completed during the night-time. The night-time works would be undertaken by an approved contractor between 10:00 pm and 7:00 am. Through effective early planning and informed selection of noise mitigation the Council can minimise the disturbance to neighbouring properties. Noise mitigation will be provided for all programmed night-time road work sites.

This noise risk assessment document is a planning tool developed by Council for the early consideration of noise during the planning and programming of road maintenance activity that will be undertaken during the night-time. The risk assessment will be used to assess the level of noise risk for a specific site and then to select suitable noise mitigation measures in a transparent and uniform manner for all relevant sites.

This risk assessment process is intended to be applied only after the Council decision that a certain site from the annual programme of road maintenance works is to be selected for delivery during the night-time period. Recording details of the decision to undertake the work at night-time is beyond the scope of this document but reasons for that decision may include issues such as opportunities for improved public and worker safety, expectations of enhanced efficiency of delivery, avoiding expected clashes with essential daytime network routes, and some projects can be delivered more cost effectively during the night-time.

During the development of this planning tool, the Council has engaged specialists to undertaken detailed noise modelling of the planned work activities, to understand the distances from the work site at which the effects from noise will be greatest. Planning for the works at a specific site will include notification of affected receivers. The setback distances that will be used to plan for notification of the works are shown in table 1.1.

**Table 1.1 – Notification distances**

Activity	Typical plant used	Average setback distance from site extents for notification purposes (m)
Line marking	Line marking machine	50
Road sweeping	Vacuum sweeper truck	500
Milling	Profiler Trucks Broom	500
Surfacing (AC)	Asphalt paver Trucks Vibratory roller Broom Bobcat	500
Surfacing (Chip Seal)	Spray truck Chip spreader Trucks Broom	500

There are also manual tasks associated with the works that have the potential to generate high noise levels for short periods of times, such as operation of a seal cutting saw and hydraulic rock breaker. Noise mitigation for these two noise sources is outlined in section 3.0.

The following pages provide a method for assessment of noise risk based on factors such as the number of potentially affected receivers and provides a method for the selection of suitable noise mitigation measures.

The documentation should be completed in cooperation between the Council and the approved road works contractor during planning for the work. The completed documentation will be distributed to the contractor representatives undertaking the works and to the Council Monitoring Team at least thirty days prior to the commencement of the works. The completed documentation will provide noise management guidance for the people in control of the site during the time allocated in the document. Other documentation will be generated during planning for the works, including notification information for residents, site plans and contractor's safety management plans. Section 6.0 of this document provides an overview of the document control and record retention process.

The risk assessment process detailed in this document has been developed in consideration of the following guidelines:

- New Zealand Standard NZS 6803:1999 Acoustics – Construction noise
- London Good Practice Guide: *Noise and vibration for demolition and construction*, July 2016
- British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites Part 1: Noise*

## 2.0 SITE NOISE RISK ASSESSMENT

As stated previously, the following risk assessment process is intended to be applied only after the Council decision that a specific site from the annual programme of road works is to be selected for delivery during the night-time period.

The risk assessment process consists of the following tasks:

- Determine the site noise risk level rating.
- Identify noise mitigation measures.
- Acceptance and implementation of mitigation measures.

### 2.1 Site noise risk level rating

The level of noise risk will depend on the type of works planned and various circumstances in relation to the site. To quantify the level of noise risk for a specific site, first tick all the appropriate “Site and work details” cells in table 2.1.

**Table 2.1 – Noise risk assessment**

Site and work details	Tick	Lower noise risk site	Higher noise risk site
<b>Work scheduling</b>			
No work planned for Sundays or Public Holidays. This means no works will be undertaken later than midnight on Saturday nights.	<input type="checkbox"/>	This applies to all sites	
<b>Line Marking works only</b>			
Noise from line marking works is low level. As such, all sites that involve line marking works only are considered lower noise risk sites. Please see section 3 for noise mitigation measures.	<input type="checkbox"/>	Y	N/A
<b>Existing levels of transport noise</b>			
Site within 500 m of a major transportation noise source (road or port related), or	<input type="checkbox"/>	Y	N
Site further than 500 m from a major transportation noise source (road or port related)	<input type="checkbox"/>	N	Y
<b>Receiver catchment type</b>			
Urban – Medium density of housing Site surrounded by a mix of residential dwellings, open space, commercial properties, or	<input type="checkbox"/>	Y	N
Urban – High density of housing Site surrounded by residential dwellings, or	<input type="checkbox"/>	N	Y
Urban – Inner city	<input type="checkbox"/>	Y	N
<b>Programme duration</b>			
1 to 3 nights at one site, or	<input type="checkbox"/>	Y	N
More than three nights at one site	<input type="checkbox"/>	N	Y
<b>Known risk elevators</b>			
History of noise complaints inside the activity setback distance, or	<input type="checkbox"/>	N	Y
No history of noise complaints inside the setback distance	<input type="checkbox"/>	Y	N
Sensitive use spaces within the activity setback distance, or	<input type="checkbox"/>	N	Y
No known sensitive spaces with the setback distance	<input type="checkbox"/>	Y	N

If any of the ticked cells share a row with a shaded cell in the “High noise risk site” column then that site will be given a “High noise risk site” rating. There are additional noise mitigation measures in table 3.1 below that should be considered for these sites.

### 3.0 NOISE MITIGATION MEASURES

The measures identified in table 3.1 represent good practice noise mitigation measures identified by the Council as being practicable for the night-time works. Noise mitigation will be provided for all programmed night-time road work sites. The following table includes the minimum mitigation measures which will be provided for all sites and a further list of options that will be selected depending on the risk rating attained in the previous section.

**Table 3.1 – Noise mitigation measures**

Mitigation measures for all sites
<b>Community notification and communication</b>
<p>At least five days prior to commencing works, use the agreed community notification process to inform the relevant residents of the impending works. Base the notification on the setback distances for the planned activity. The setback distances are to be measured from the extents of the site:</p> <ul style="list-style-type: none"> <li>- Line marking – 50 m</li> <li>- Road sweeping – 500 m</li> <li>- Milling – 500 m</li> <li>- Surfacing (AC) – 500 m</li> <li>- Surfacing (Chip seal) – 500 m</li> </ul> <p>The community notification will cover the areas within the setback distances and advise residents about the reasons and duration of work that will be undertaken during the night-time.</p> <p>The communication to residents will include information relating to:</p> <ul style="list-style-type: none"> <li>- Works plan showing the extents of the work.</li> <li>- Planned dates and times of operation.</li> <li>- Arrangement for vehicular access to affected properties, if required.</li> </ul> <p>The correspondence will also include contact details for persons in control of the works and allow for feedback from residents about any special needs they may have regarding the expected noise effects during the planned work period.</p>
<b>Site planning and layout</b>
Consider the size of the site necessary to complete the planned works and minimise the extent of the site.
Take advantage of any available screening when planning the site layout.
Locate semi-static plant items such as generators as far from the nearest receivers as possible.
<b>Activity scheduling</b>
Aim to undertake the noisiest activities prior to 11:00 pm.
This includes the use of seal cutting saws and hydraulic rock breakers. Further mitigation for these two noise sources is required for High noise risk sites, as outlined in the “Further mitigation measures to be considered” section of this table (below).
Shut down all plant and equipment in intermittent use or throttle it down to a minimum.
<b>Control of the site during the works</b>
Designate responsibility to site staff to take necessary steps on behalf of the contractor to manage noise according to the circumstances relating to the work location.
Readily provide the details for the relevant contact, if any member of the public approaches the site staff to make enquiries about the works.

<b>Vehicle movement to and from the sites</b>
Minimise the quantity of vehicle movements to and from the site.
Plan the deliveries and vehicle movements so that vehicles are not waiting or queuing near receiver locations.
Use “Just in time” delivery where possible.
If waiting or queuing is unavoidable then engines should be turned off.
Loading and unloading should be carried out as far as possible away from sensitive receivers.
Encourage drivers to use behaviour that limits the emission of noise from their vehicles.
Trucks should not use engine brakes when approaching or leaving the sites.
<b>Quiet equipment selection and use</b>
Use trucks and other plant items that have serviceable residential area type exhaust systems and are compliant with the relevant national design rules.
Ensure all silencers are in good working order.
Do not use engine compression brakes on or around the site.
Reversing alarms have the potential to create annoyance.
The use of the following alternatives will be considered:
<ul style="list-style-type: none"><li>- Broadband reversing alarms.</li><li>- Variable level alarms.</li><li>- Non-audible warning systems such as flashing lights, reversing cameras or spotters.</li><li>- Proximity alarms which detect the distance from objects and generate an audible alarm in the cabin for the driver.</li></ul>
Please note, the ability of the alarm system to provide a safe system of work should be considered when selecting an alternative to tonal reversing alarms.
Mobile plant and trucks operating on site for a significant portion of the works should have reversing alarm noise emissions minimised in-so-far-as possible, recognising the need to maintain workplace safety.
Vibratory compaction equipment shall be used in a mode which minimises the incident vibration at nearby receivers.
Consideration should be given to engaging concentric weights only when running at speed to avoid run-up, run-down resonances, the use of smallest possible equipment, or turning off the mechanical vibration on vibratory rollers and undertaking more passes for areas where there is a risk that disruption may occur at receivers.
Use methods to minimise noise caused by dropping material into truck bodies such as adding finer material to the bed before dropping larger material into the truck body.
To reduce drop height, use lower sided trucks without “Hungry boards” fitted.
Delivery vehicles should be fitted with straps instead of chains for securing loads where possible.
<b>On-site communications</b>
No public-address communication systems should be used during the works.
Radios should be operated at volumes no louder than needed to maintain clear communication.
Do not use vehicle horns to communicate between plant and operators. Find alternative methods.

<b>Training for site staff</b>			
Site induction training for all site staff should include a noise awareness component.			
Noise awareness training topics covered at pre-start meetings should include:			
<ul style="list-style-type: none"> <li>- The requirements of the consent for night-time road works and the team member's personal responsibilities including expected behaviours.</li> <li>- The location/s of the nearest sensitive receivers.</li> <li>- General noise mitigation requirements such as quiet plant operation, on-site communication methods, minimising noise during material handling.</li> <li>- Requirement for site specific controls identified during the project planning.</li> <li>- Designated employee parking areas.</li> <li>- Designated loading/unloading areas.</li> <li>- Scheduling of noise intensive activity.</li> <li>- How to manage the site if obstructions are encountered such as equipment break downs or unexpected events.</li> <li>- Community liaison process including complaint reporting requirements.</li> </ul>			
Further mitigation measures to be considered	Lower noise risk site	Higher noise risk site	Tick
<b>Activity scheduling</b>			
Consider the use of respite periods for projects that are expected to involve more than three nights work at the same site.  For example, limit night-time works to no more than three consecutive nights per week, with each period of work separated by no less than one week and the works undertaken for no more than six nights per month.	N/A	Highly recommended	<input type="checkbox"/>
<b>Control of the site</b>			
Undertake regular on-site observation monitoring to check that the best practicable options for noise minimisation are being employed.  Such checks should include: <ul style="list-style-type: none"> <li>- Hours for undertaking noisy activity.</li> <li>- Presence of specified mitigation measures, work methods and acoustic screening.</li> <li>- Number and type of plant on-site.</li> </ul>	N/A	Highly recommended	<input type="checkbox"/>
<b>Screening of semi-static noise sources</b>			
Install temporary portable noise barriers adjacent to manual tasks such as seal cutting and hydraulic breaking.  Stationary vehicles or site equipment should be located between the noise sources and receivers to provide additional screening, where practical.	N/A	Desirable	<input type="checkbox"/>
<b>Hydraulic breaking</b>			
Consider removing larger sections of spoil by lifting them out and breaking them down either in areas away from receivers, or off-site.	N/A	Highly recommended	<input type="checkbox"/>
Consider using non-percussive breaking equipment such as pulverisers.	N/A	Desirable	<input type="checkbox"/>

<b>Noise control at receivers</b>			
Provide information about "masking noise" that residents can use inside the home, such as white noise or ambient sounds available from free online sources.	N/A	Desirable	<input type="checkbox"/>
Issue residents with ear plugs and provide instruction for fitment.  Free earplugs are available to collect at Nelson City Council Customer Services Centre with instructions on their use (should people want them).	N/A	Desirable	<input type="checkbox"/>

When the mitigation measures for the site have been agreed, a record of the acceptance of the mitigation measures should made in table 3.2.

**Table 3.2 - Acceptance by people responsible for implementation of mitigation measures**

Task	Details/Comments (if required)	Contractor representative	Council representative
Community notification completed, in accordance with requirements outlined in table 3.1.			
Specific noise related issues raised during the community notification process have been managed.			
Mitigation measures (for all sites) accepted.			
Further mitigation measures (for high noise risk sites) accepted.			

## 4.0 NOISE COMPLAINT MANAGEMENT

The Council has established methods for managing complaints received about noise. If complaints are made directly to the Council, they will typically be received by the Council's 24/7 phone service (03 546 0200<sup>1</sup>).

Details of the complaint are recorded in the Council MagiQ Service Request System and include:

- Name of customer
- Date and time of complaint
- Address of affected property
- Specific details of the complaint
- Method of communication (phone, email)
- Any other similar or related complaints
- Customer contact details for feedback

Upon receiving a complaint, a Service Request (SR) is created and assigned to a Monitoring Officer. The Monitoring Officer investigates the details of the complaint, contacts any relevant Council teams, carries out a site visit if warranted and responds to the customer. Details of the SR are saved on site against the resource consent as/where required. When the matter is resolved, the SR is closed out and the customer responded too (if they have requested a call back).

The Transport Operations team review the SR (generally the next morning) and action any findings or improvement opportunities that were identified during the investigation.

There are examples where complaints about noise are made directly to staff and contractors while they are carrying out their work in the field. To prepare for that possibility, all staff on-site will be informed of the correct procedure for handling noise complaints during the site induction training. Any complaint received by field staff in relation to the night-time works will initially be communicated to the project's Council representative and they will notify the Council Monitoring Team. The relevant field staff and contractor representatives will assist the Monitoring Officer with the complaint investigation as required.

Noise complaint investigations will be recorded in a brief report format for Council's record keeping purposes. The report will include the findings of the investigation and any further action required to address any identified areas for improvement.

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<sup>1</sup> <http://www.nelson.govt.nz/footer-elements/contact/>

## 5.0 PROJECT CONTACT DETAILS

### 5.1 Nelson City Council

Matthew Bruce

Team Leader – Transport Operations

[Matt.bruce@ncc.govt.nz](mailto:Matt.bruce@ncc.govt.nz)

M 022 010 5194

Roy Miles

Transport Operations

[Roy.miles@ncc.govt.nz](mailto:Roy.miles@ncc.govt.nz)

M 027 471 8320

### 5.2 Approved contractor

Fred Ludik

Higgins Contractors Ltd

[f.ludik@higgins.co.nz](mailto:f.ludik@higgins.co.nz)

M 027 200 9309

## 6.0 DOCUMENT CONTROL AND RECORD RETENTION

All noise related site documents, including a completed version of this document for each site and any noise complaint investigation reports should be kept by the Council for a period of at least seven years.

### 6.1 AC19355 – 03 – R3: Noise risk assessment and management statement

Document revision history

Document reference	Status	Date
AC19355 – 03 – R3	Revision 3	31 July 2020

Document acceptance

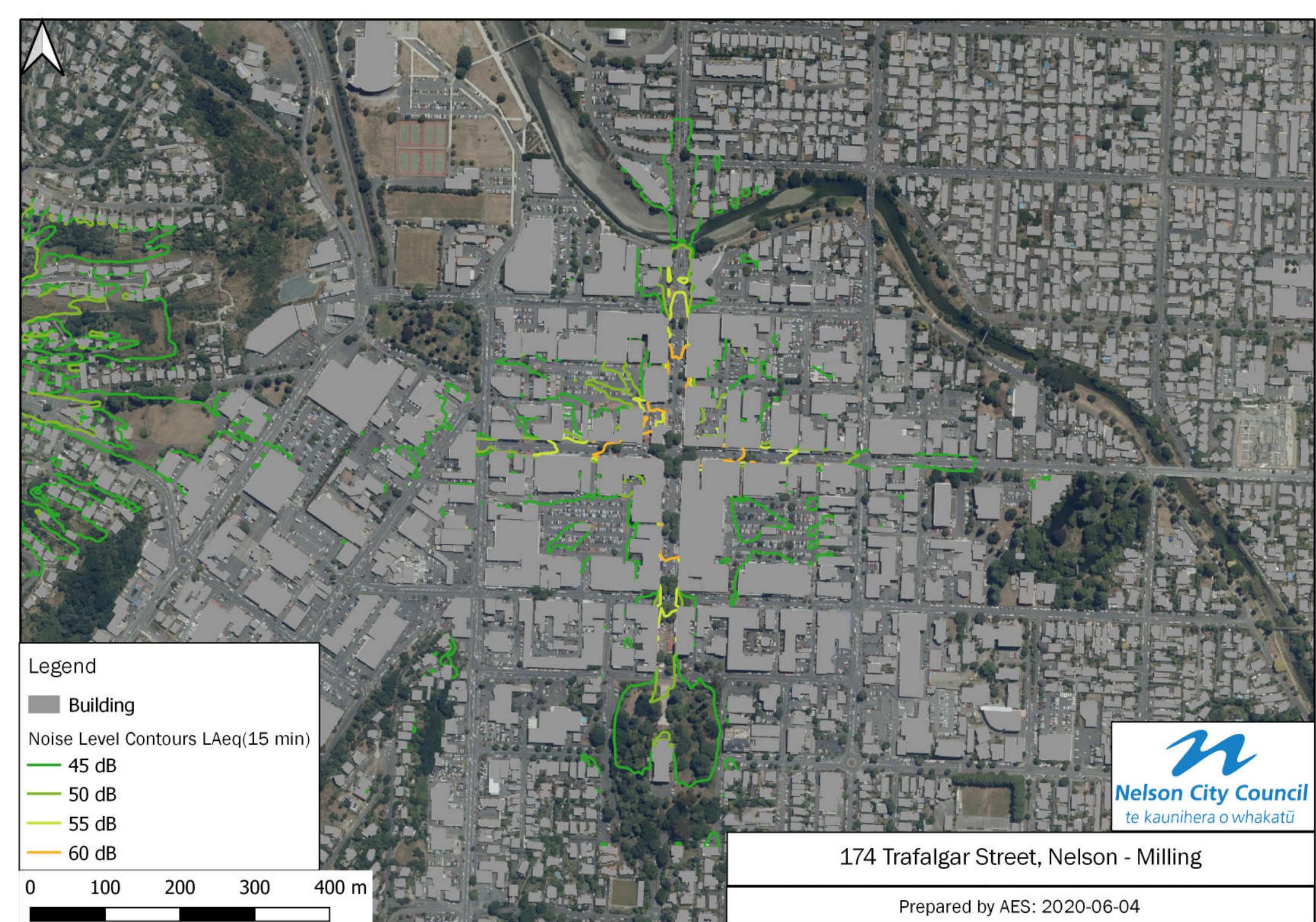
Author	Signature
James Boland Senior Acoustic Engineer Acoustic Engineering Services Ltd	
Reviewer	Signature
William Reeve Senior Acoustic Engineer Acoustic Engineering Services Ltd	
Approver	Signature
Matthew Bruce Team Leader – Transport Operations Nelson City Council	

## Appendix C

### Noise contour plots









### Legend

Building

Noise Level Contours LAeq(15 min)

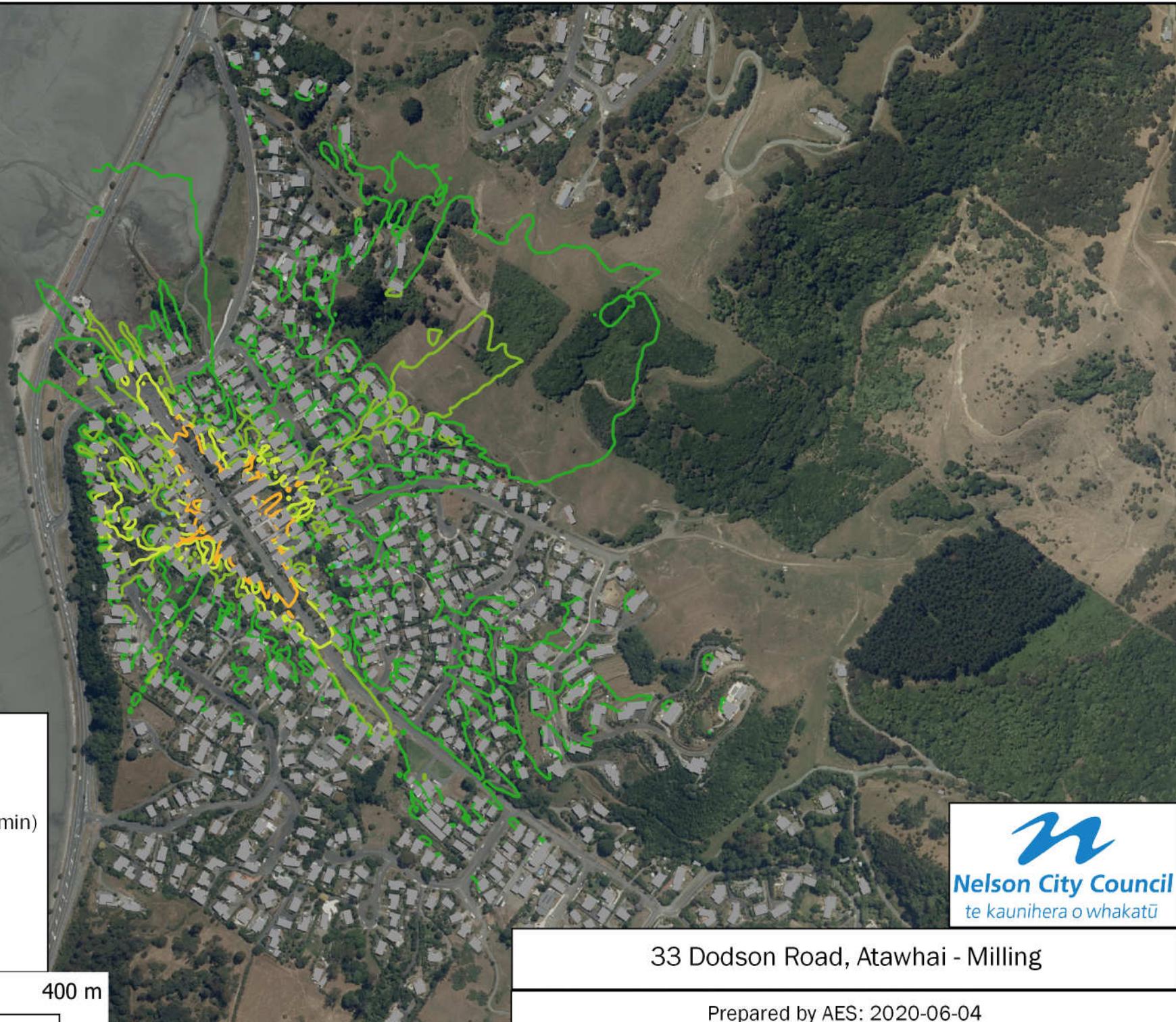
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50 dB

55 dB

60 dB

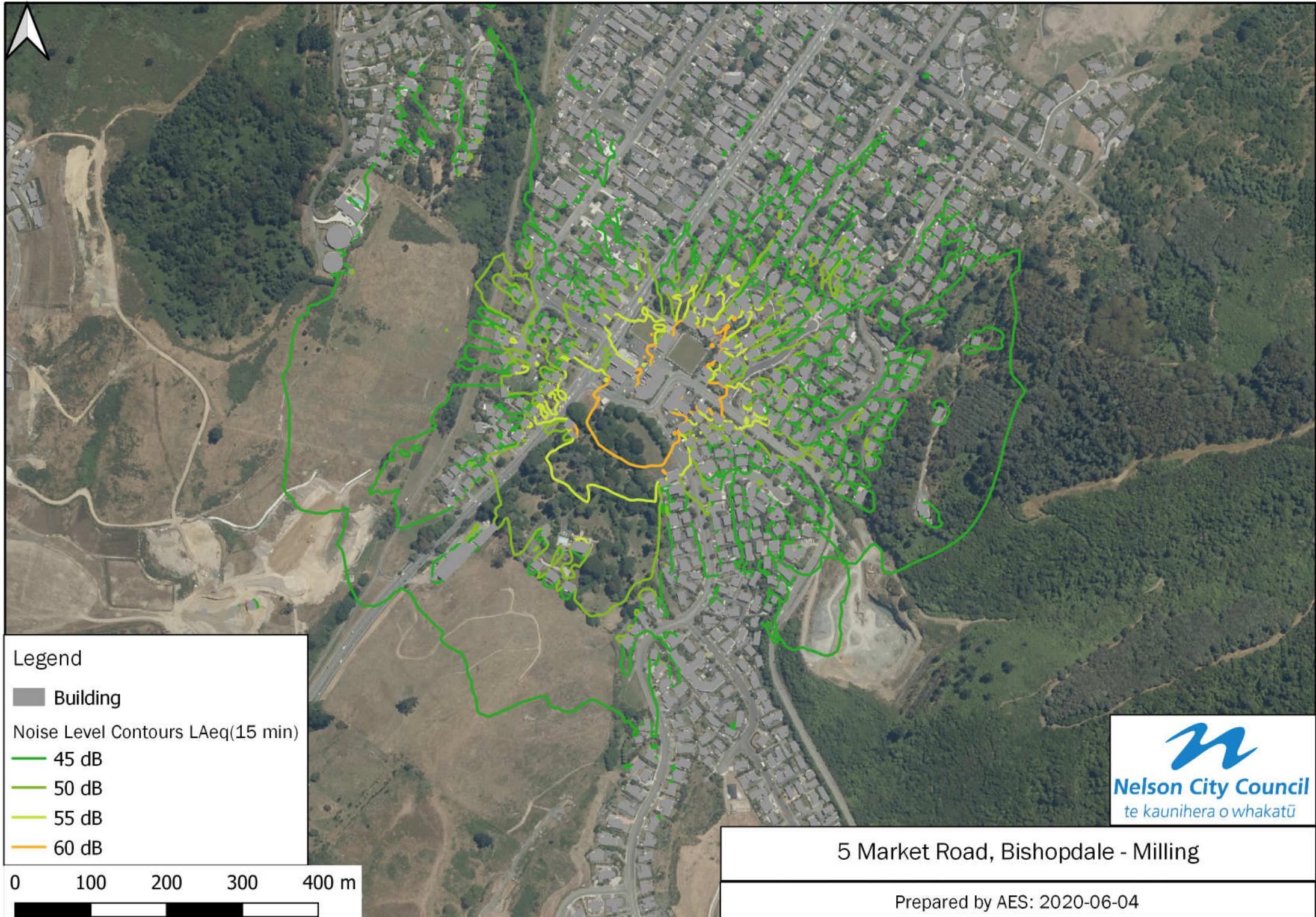
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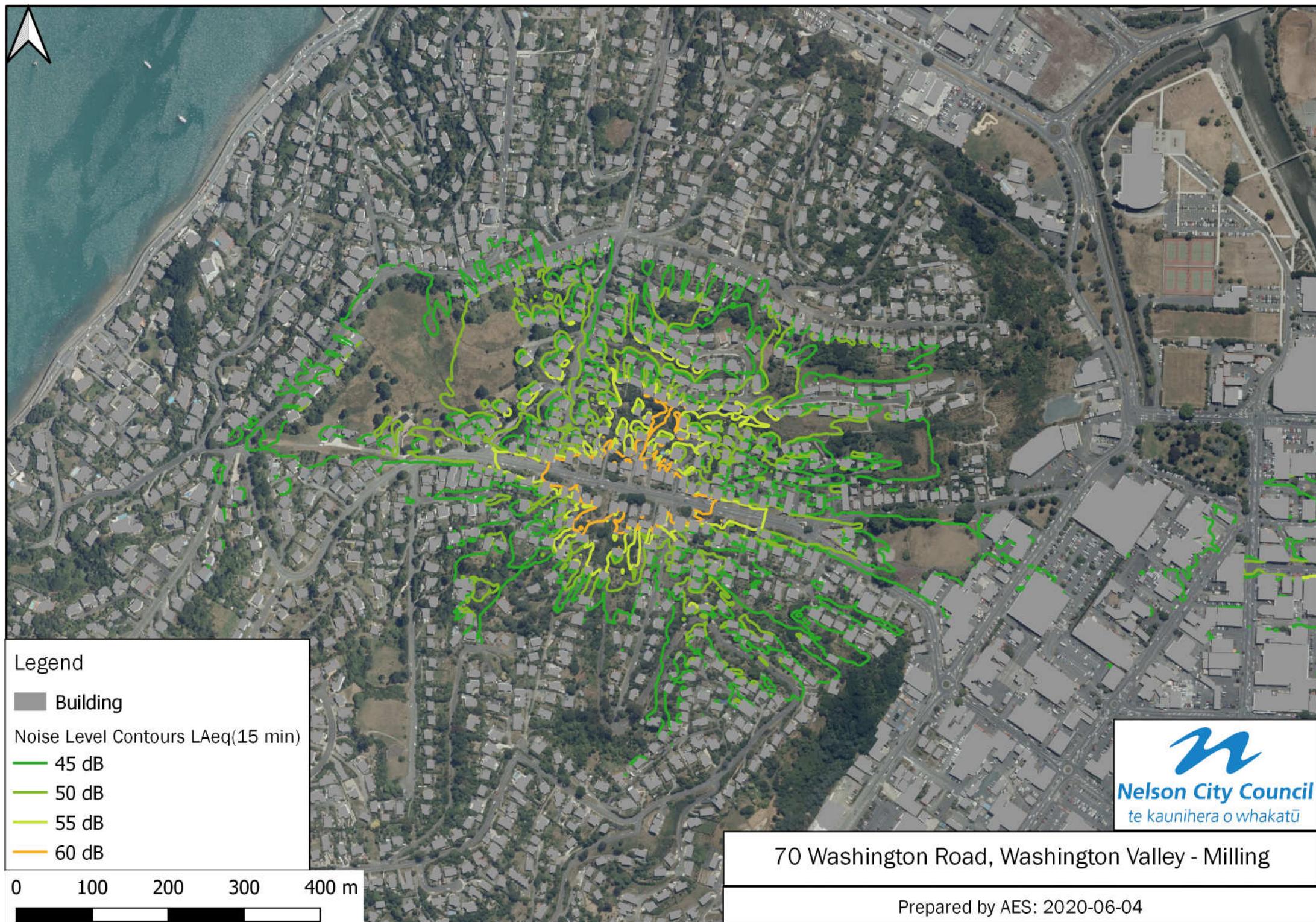


Nelson City Council  
te kaunihera o whakatū

33 Dodson Road, Atawhai - Milling

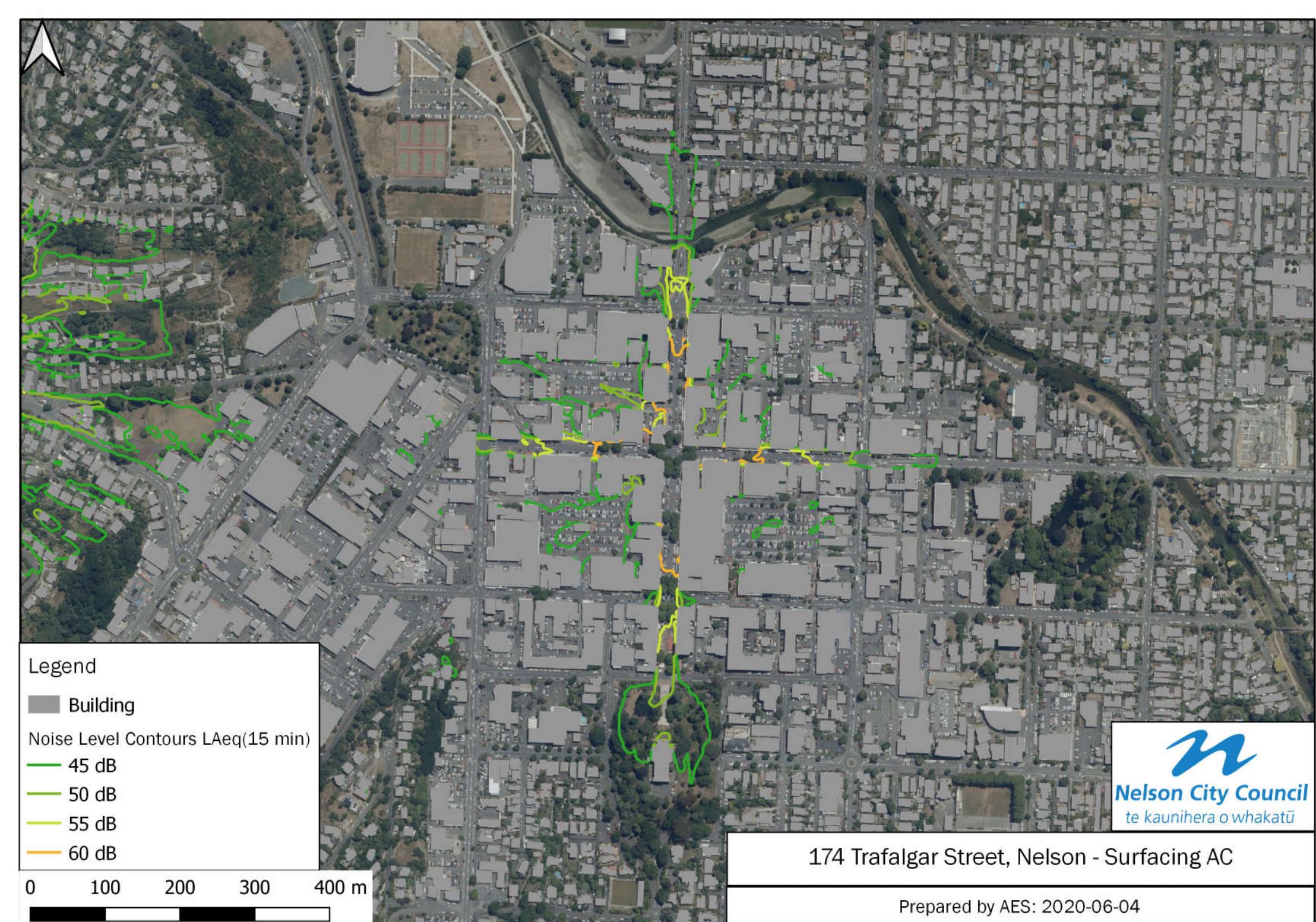
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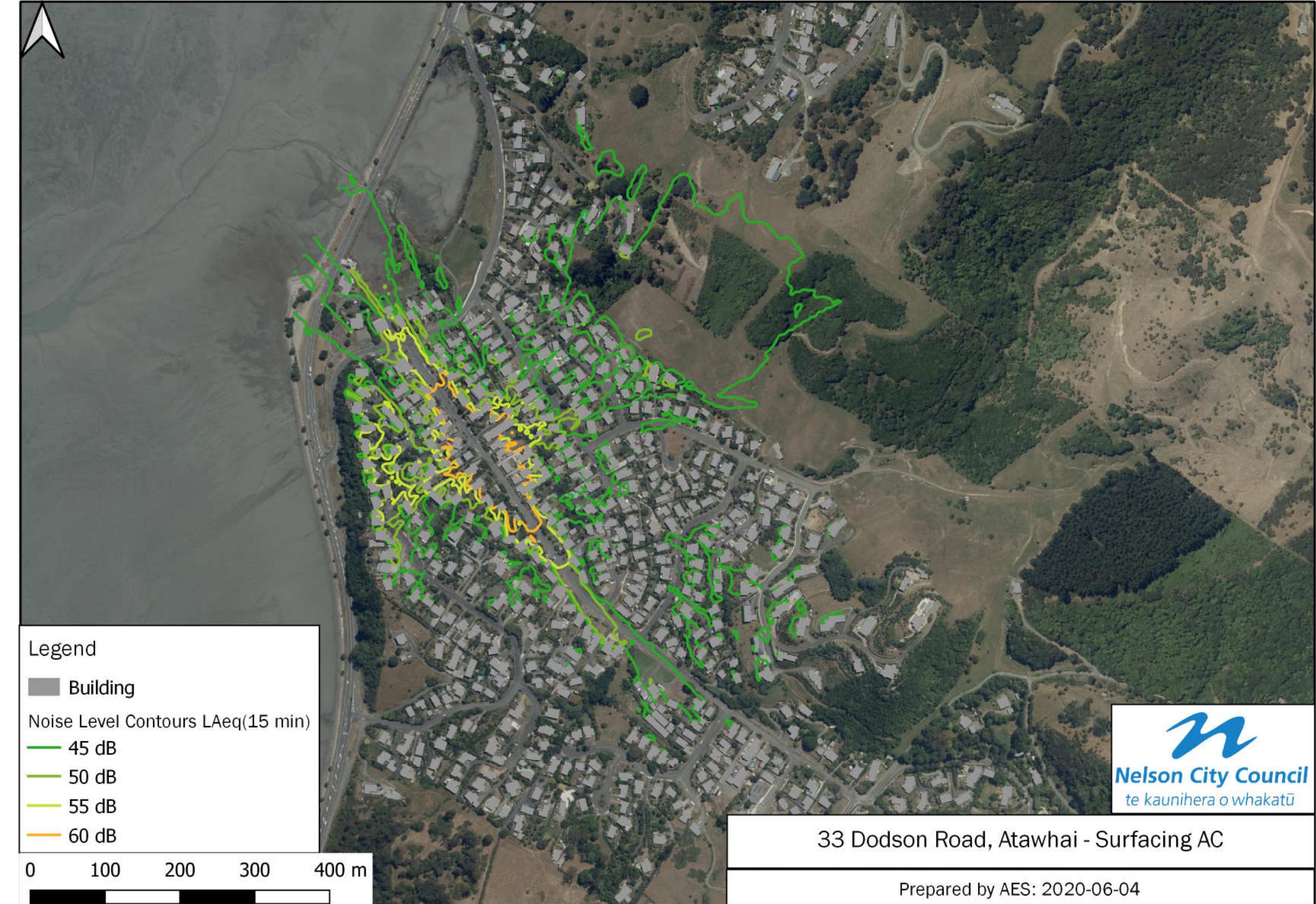




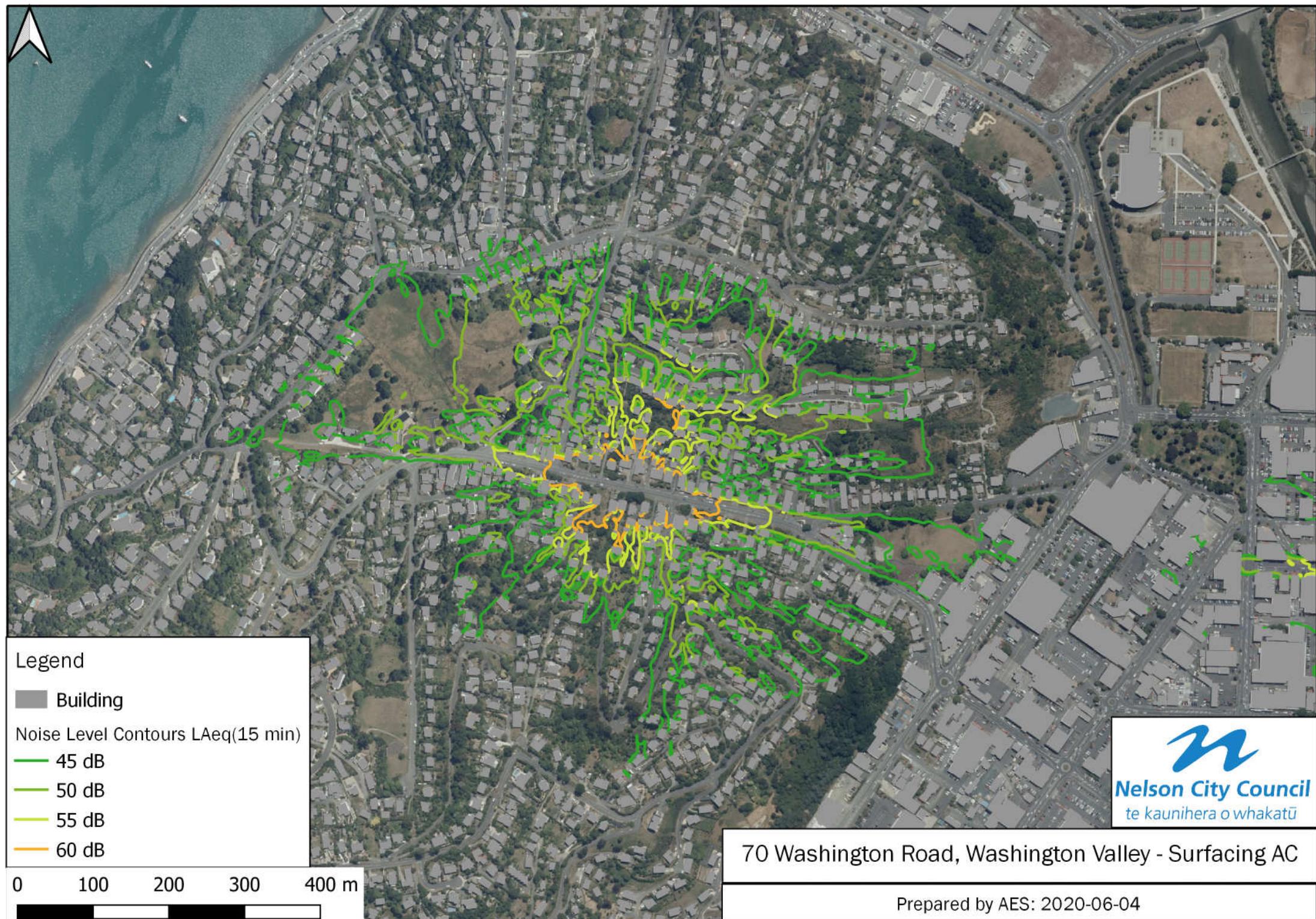






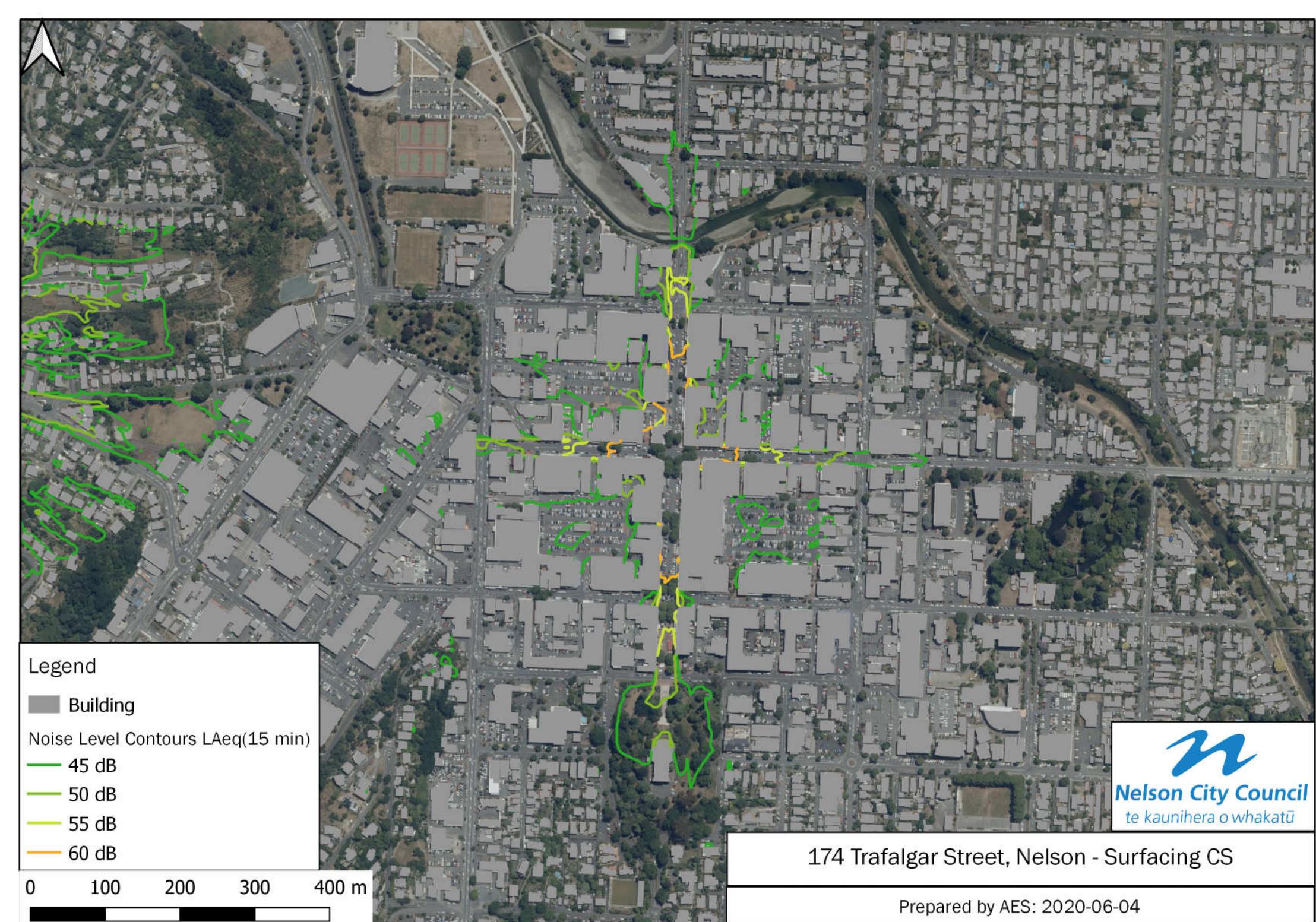




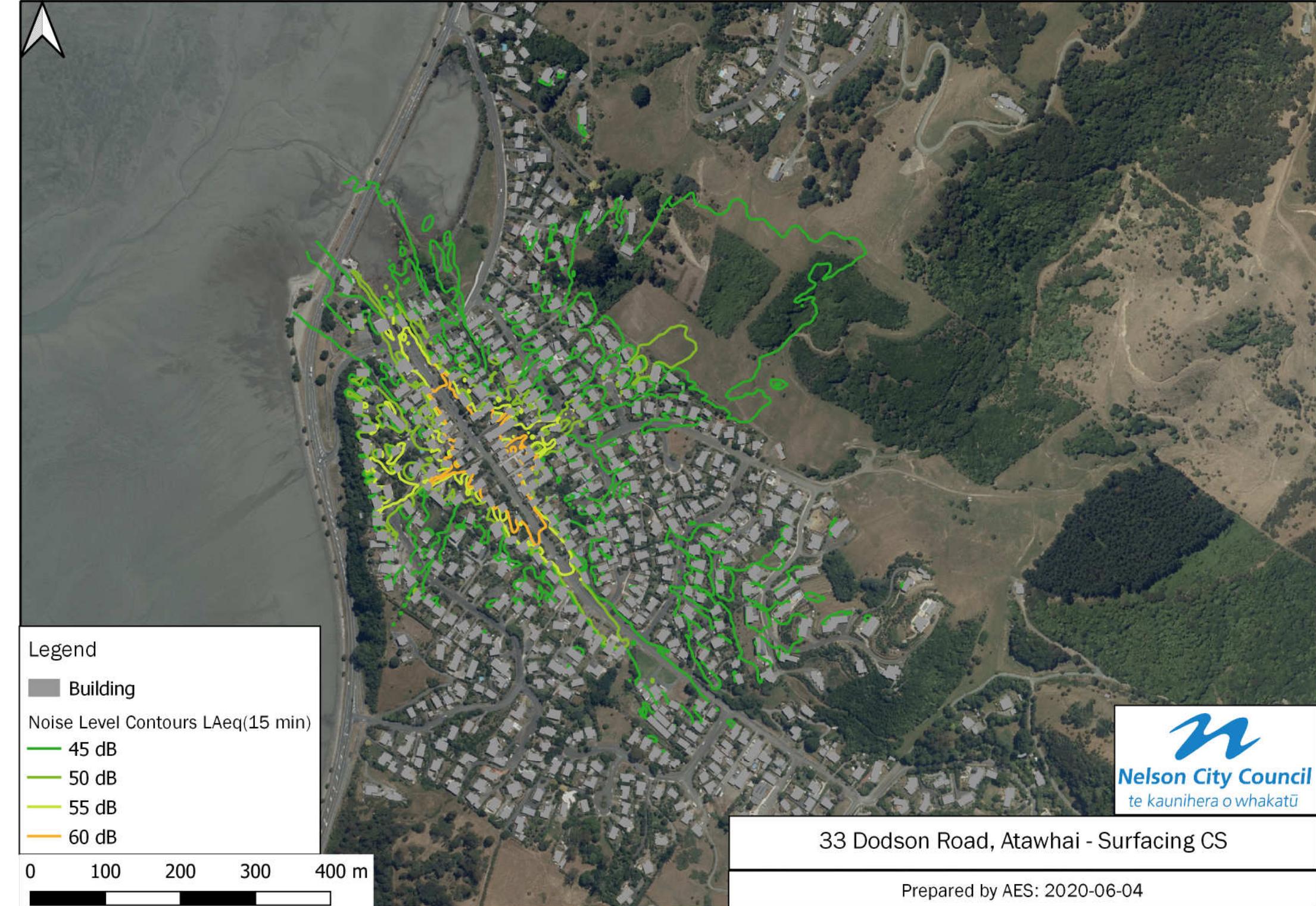


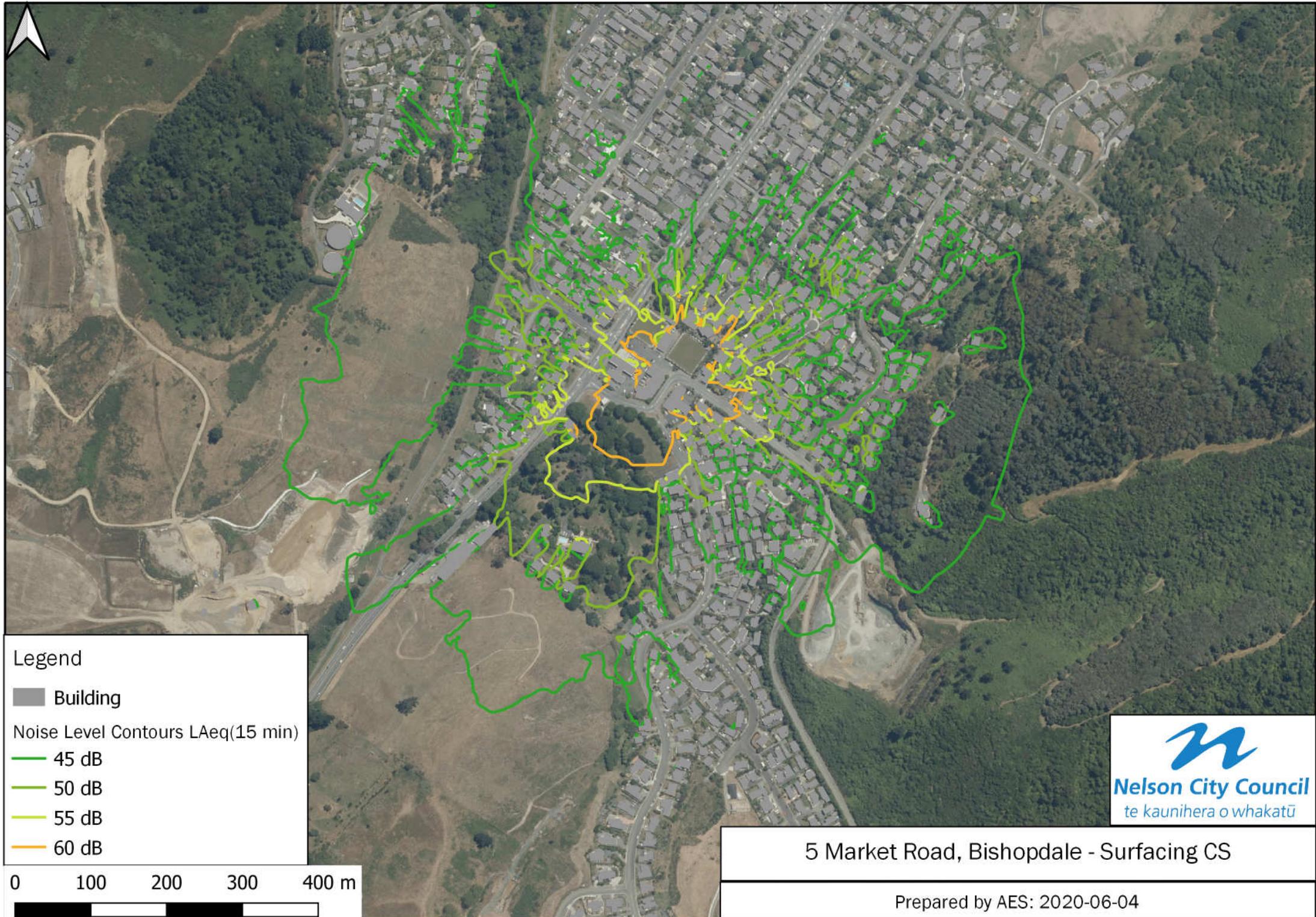


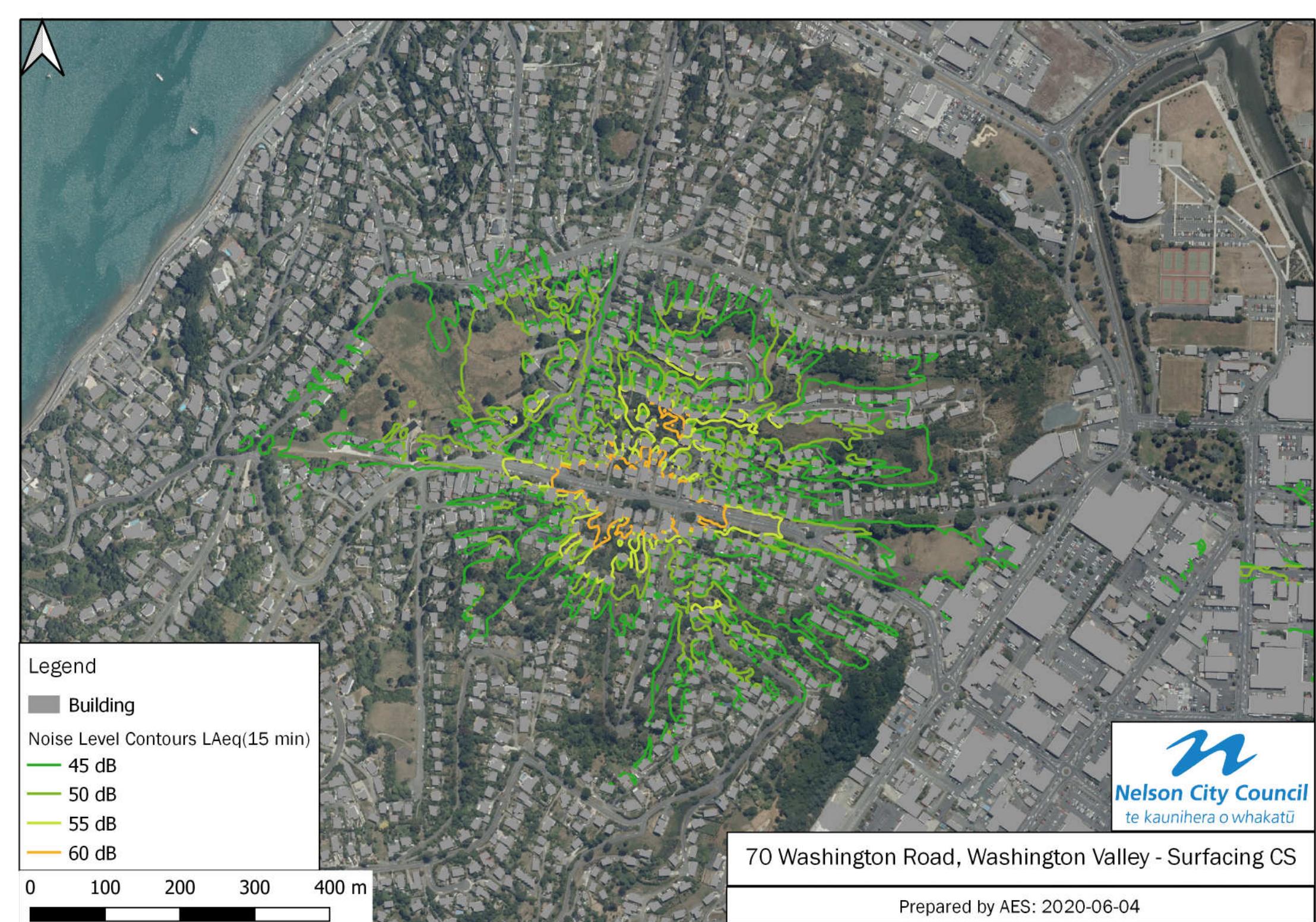


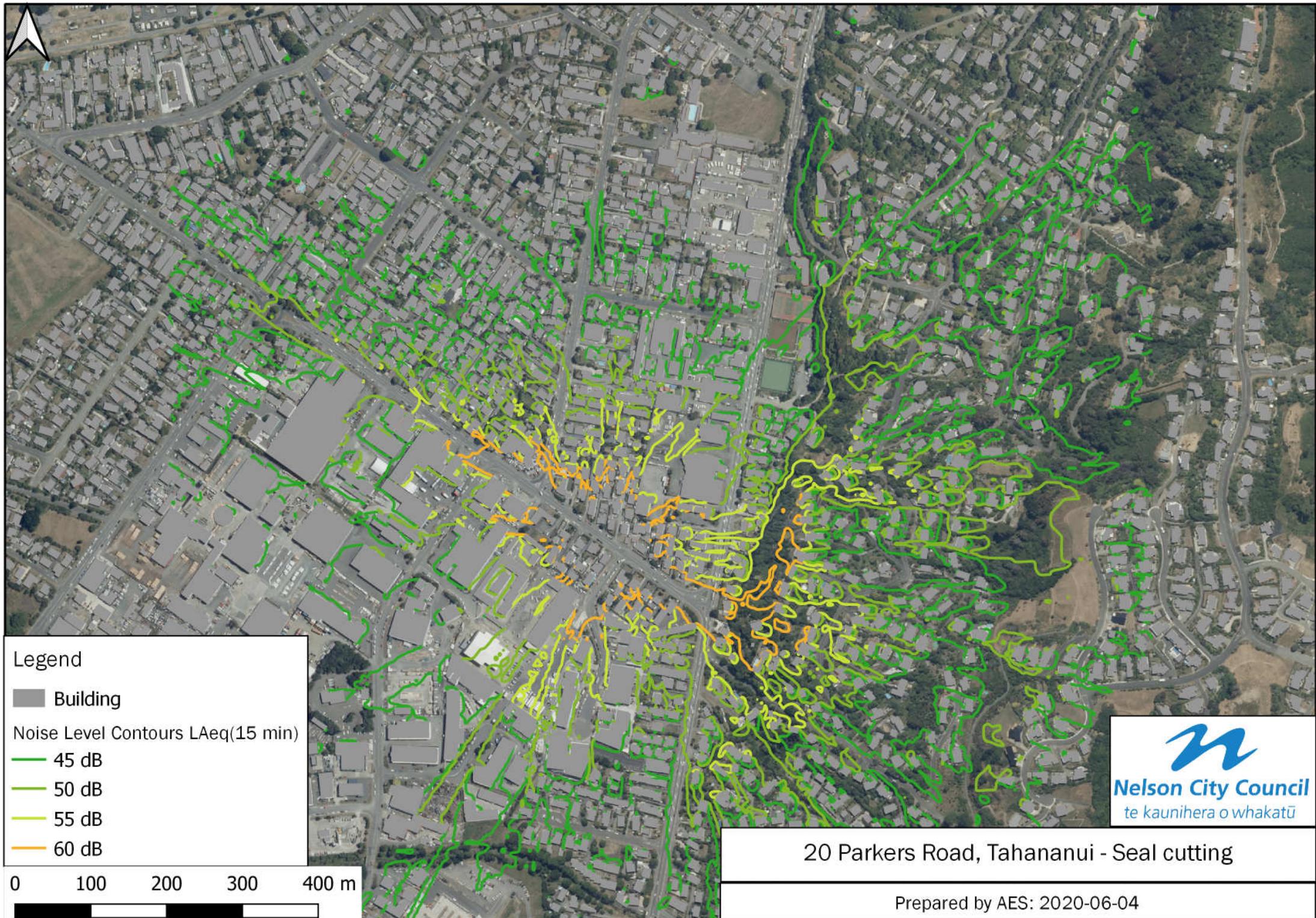


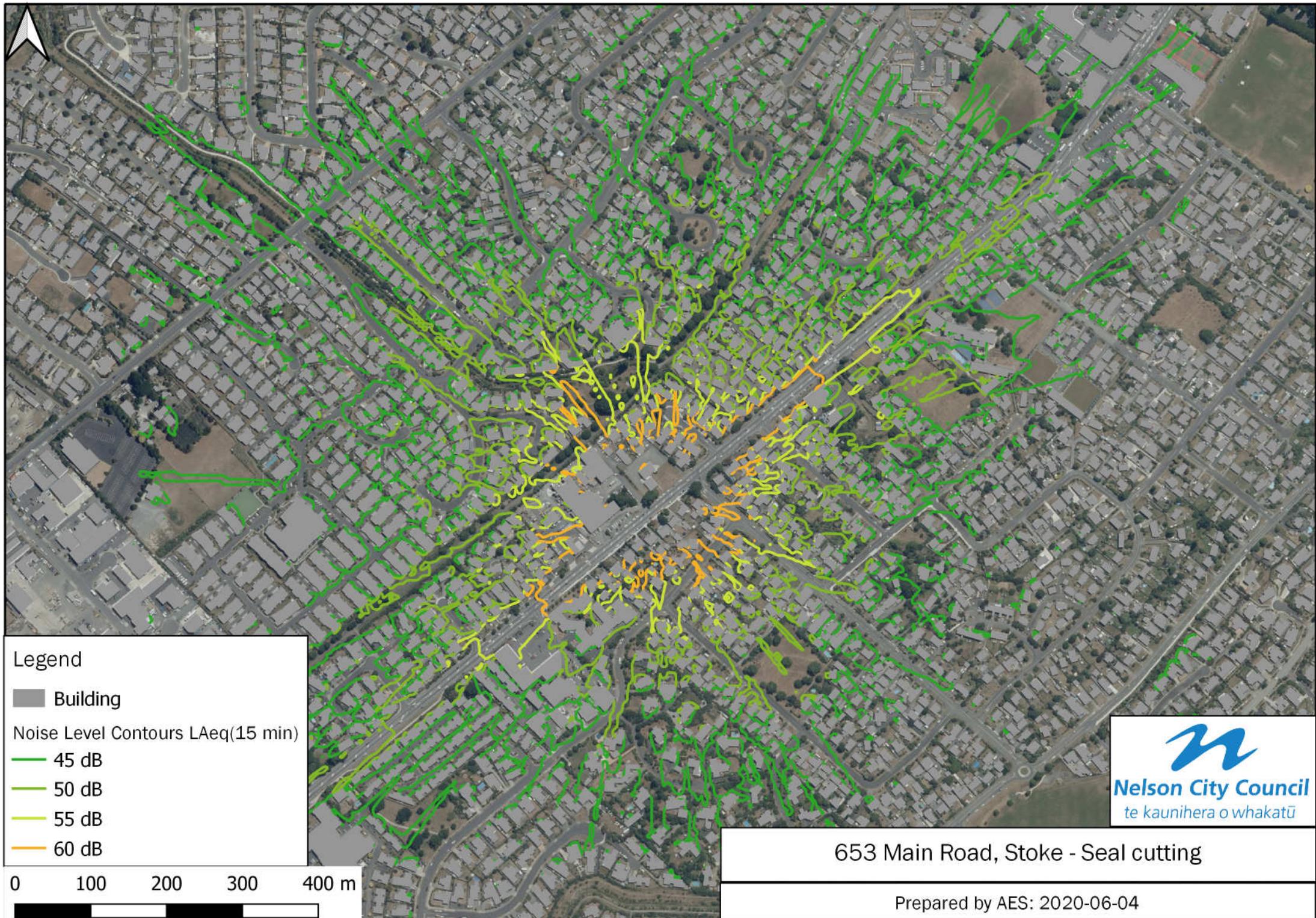
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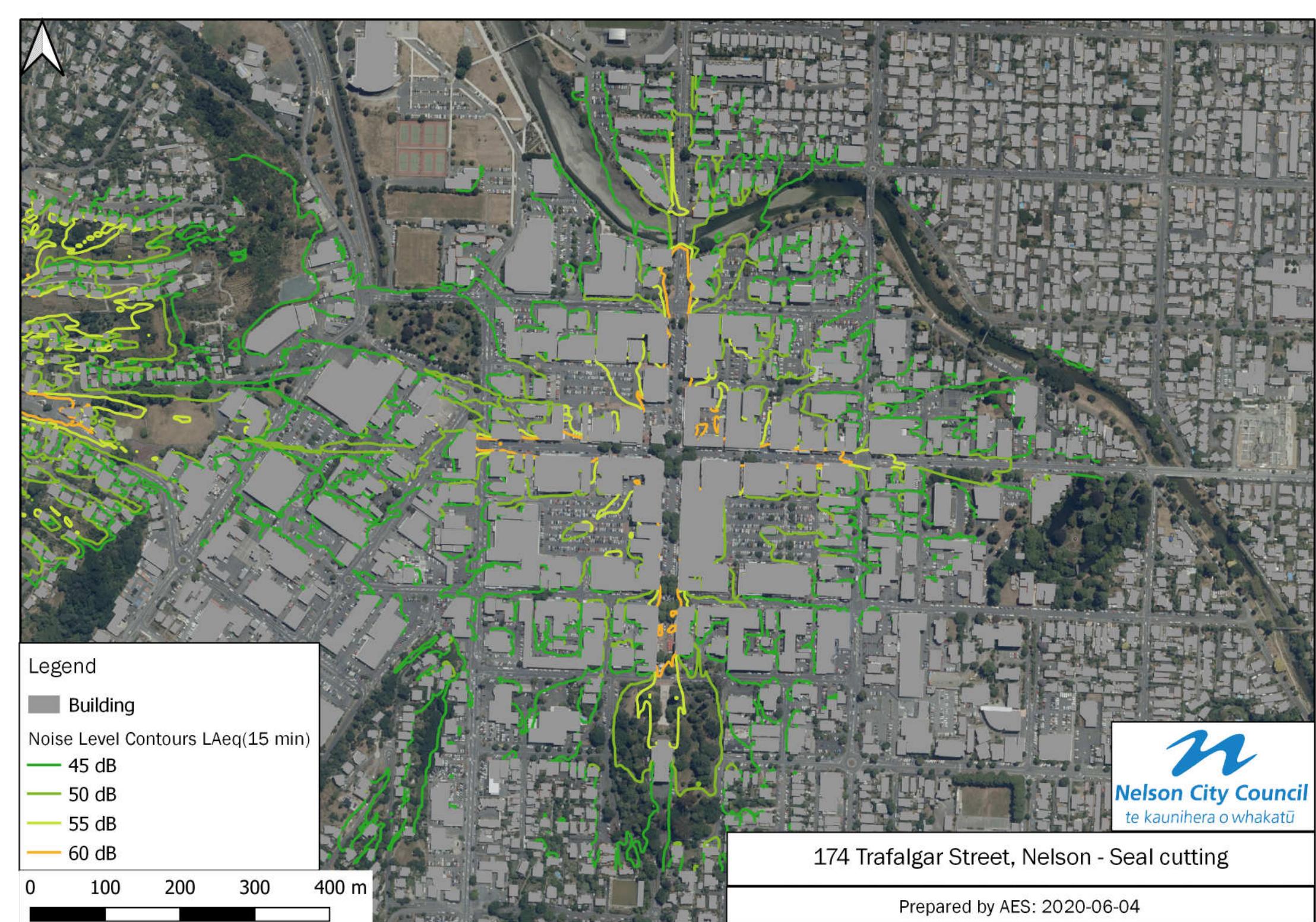


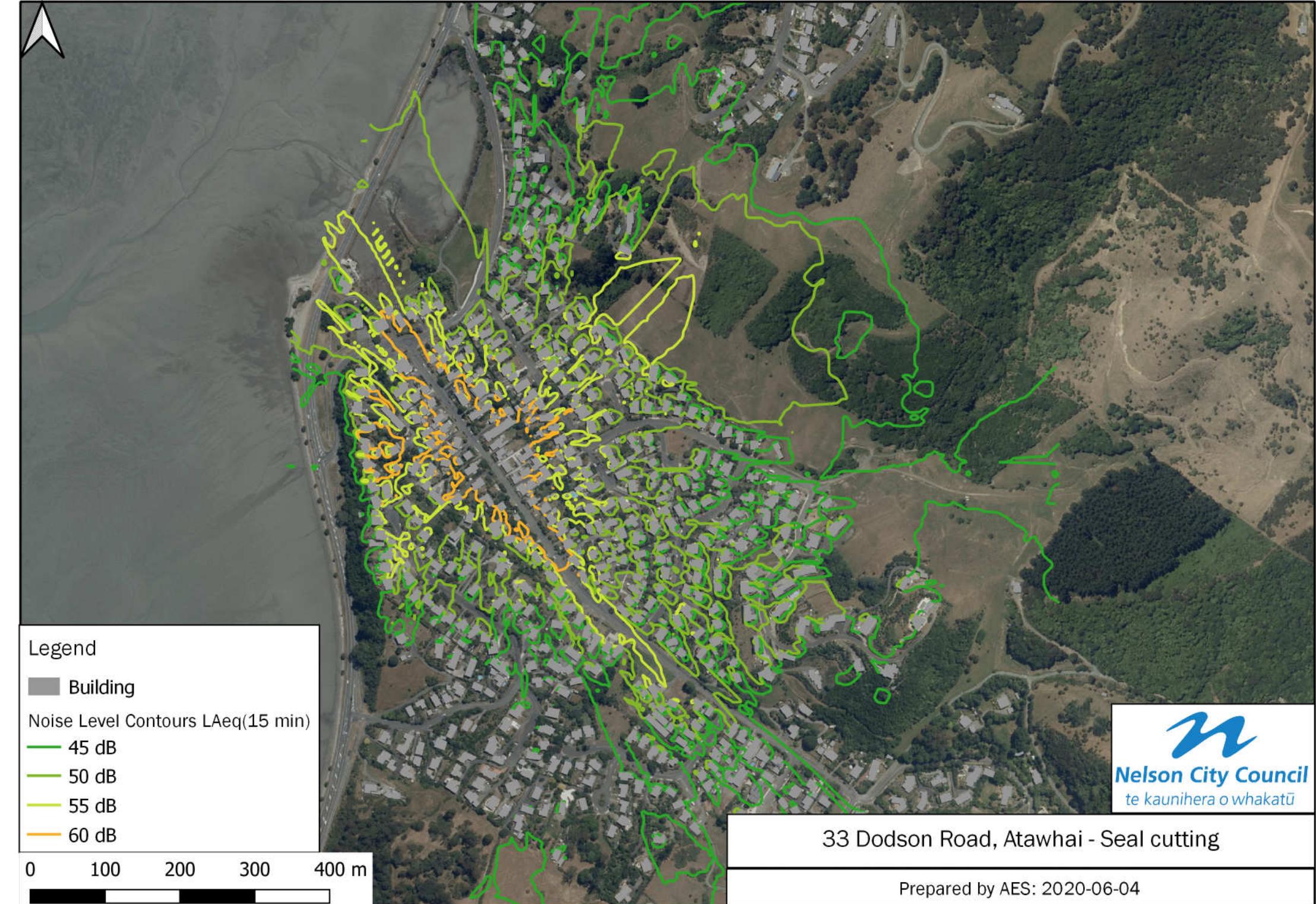


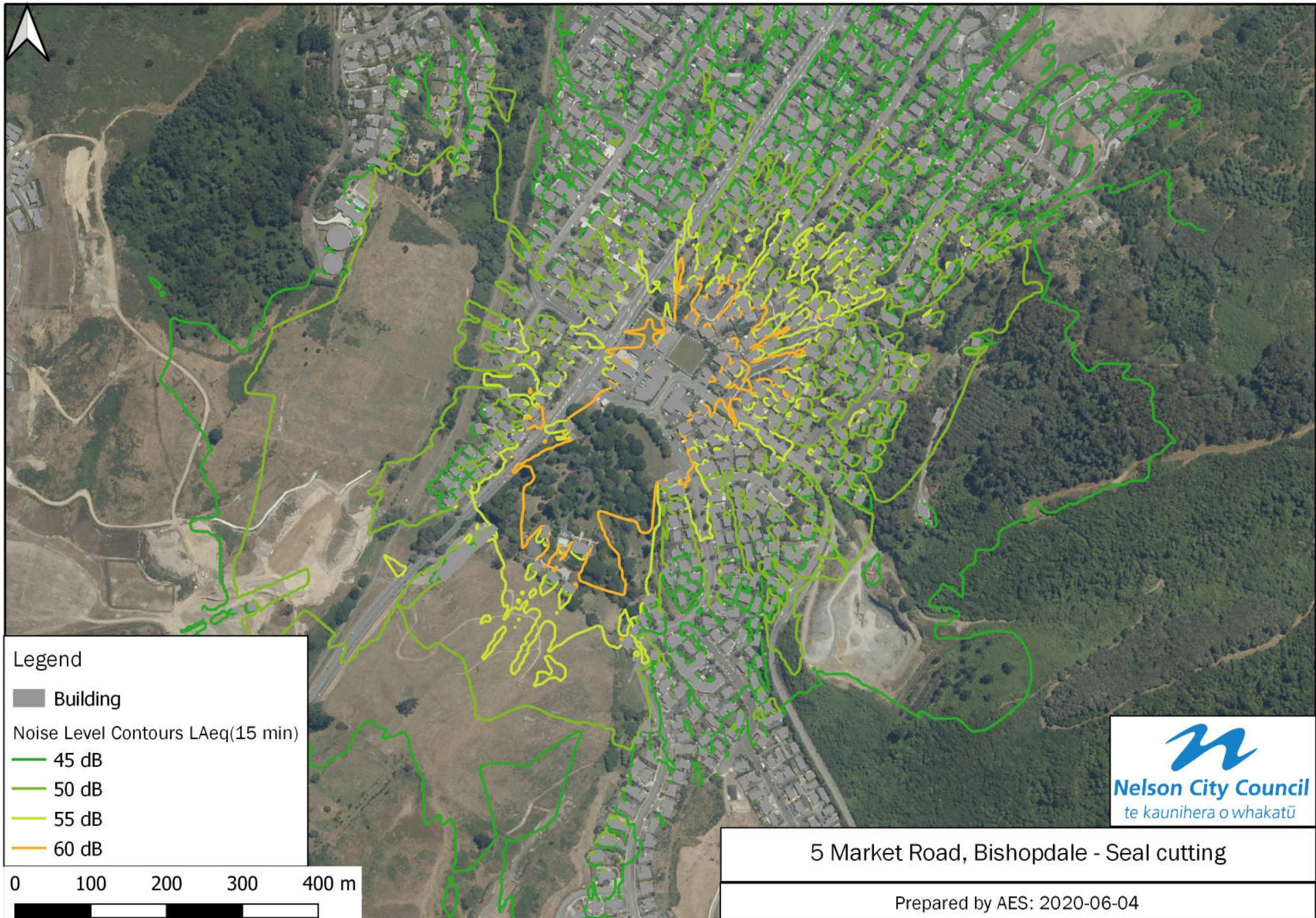


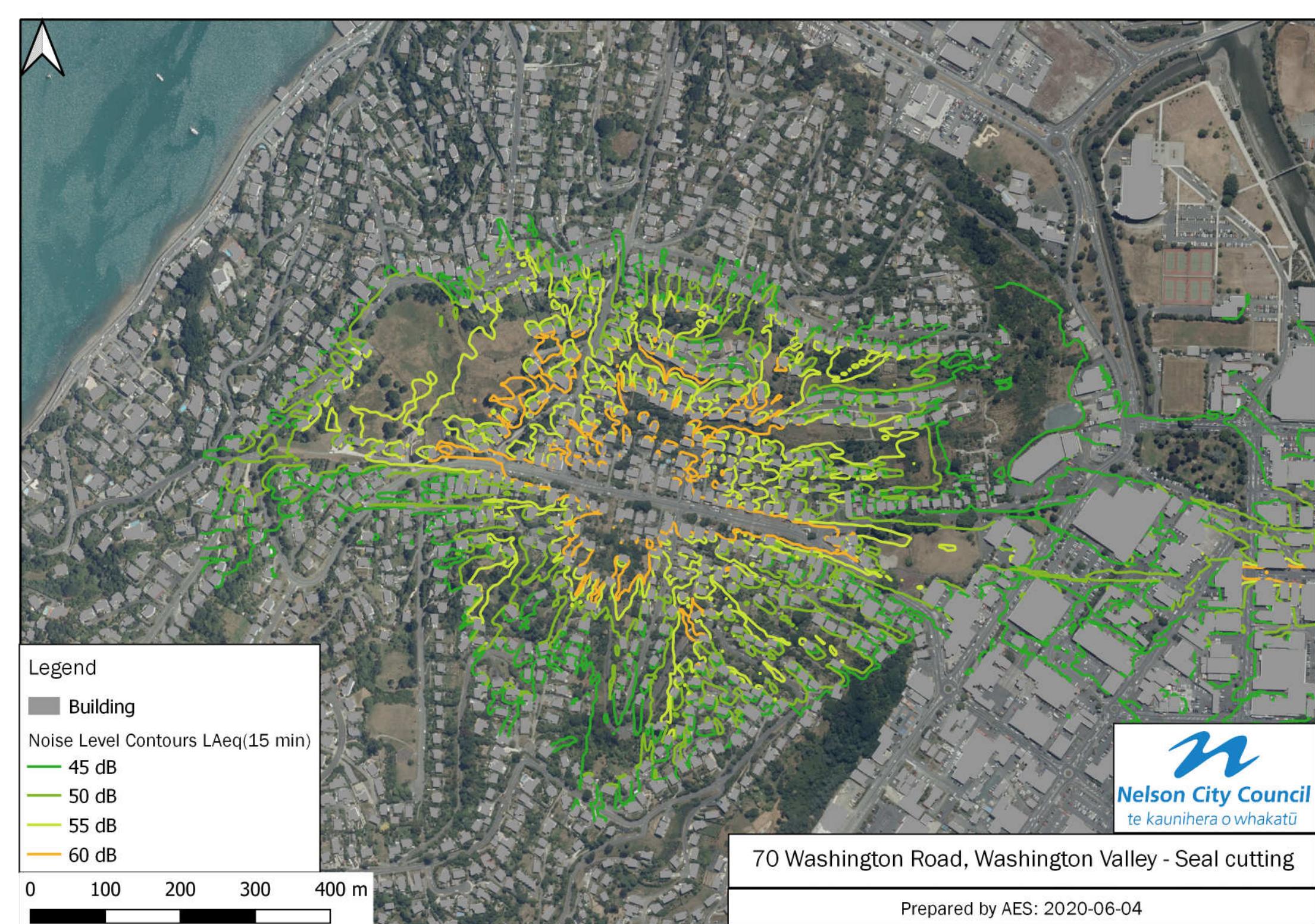




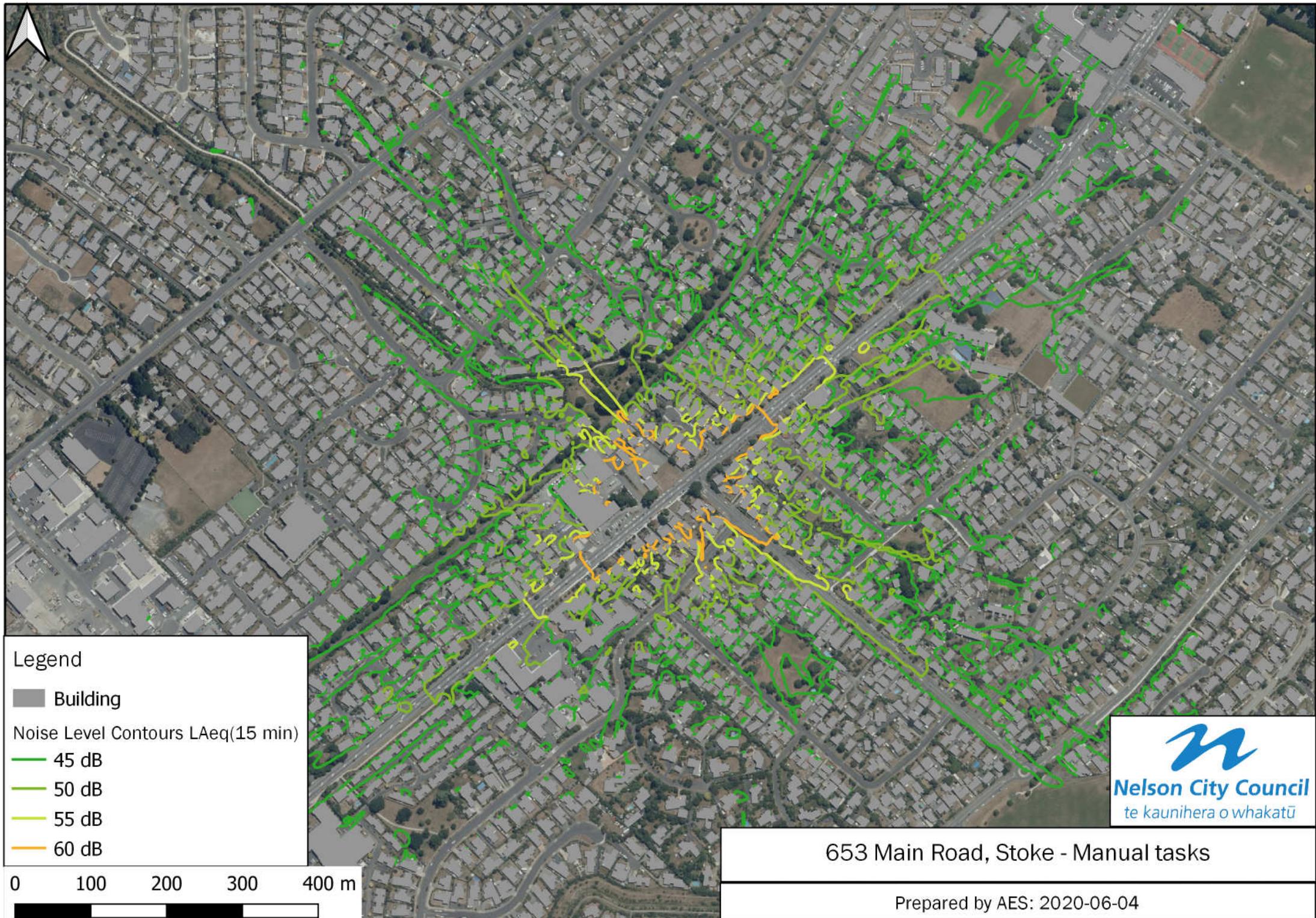


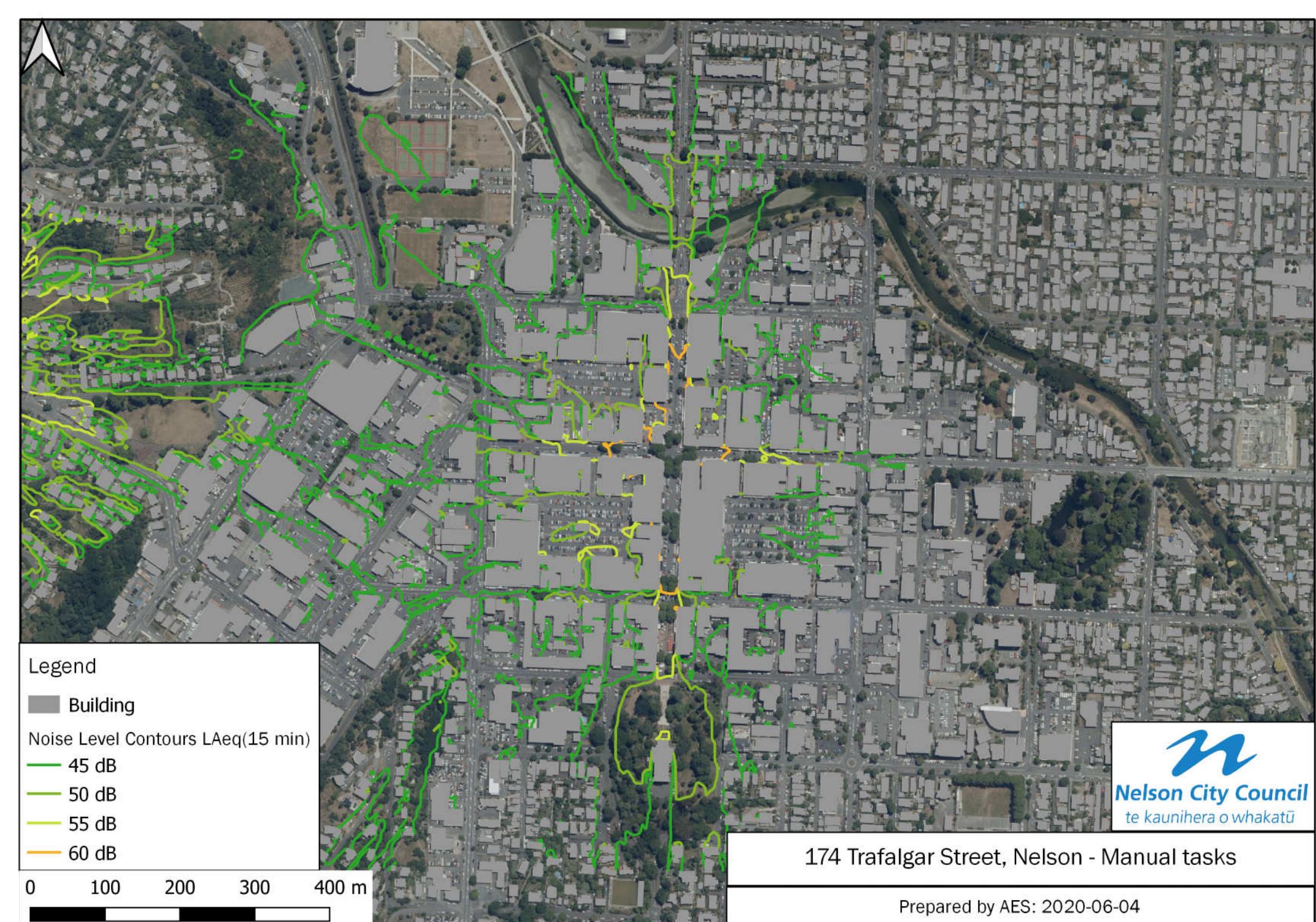


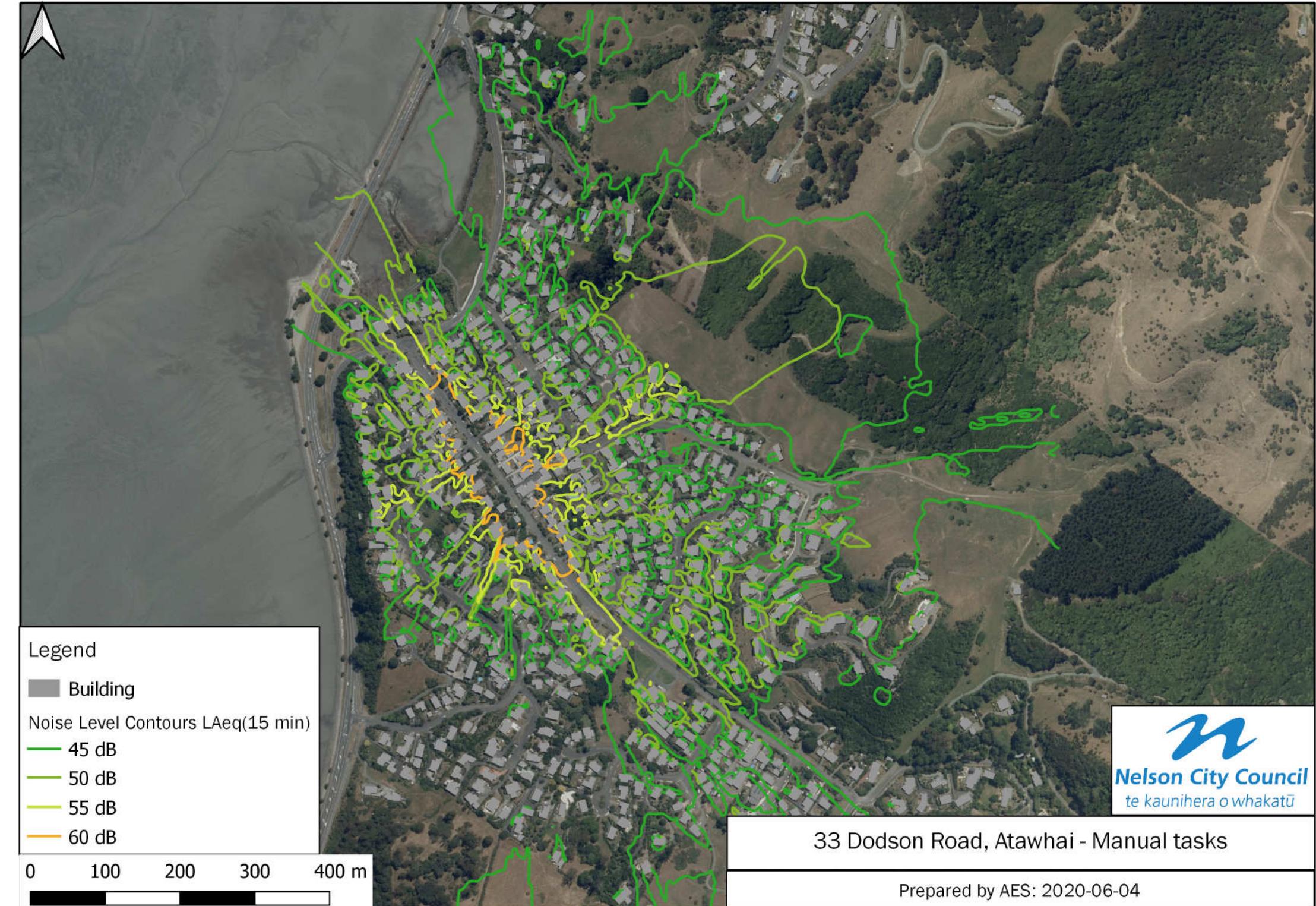




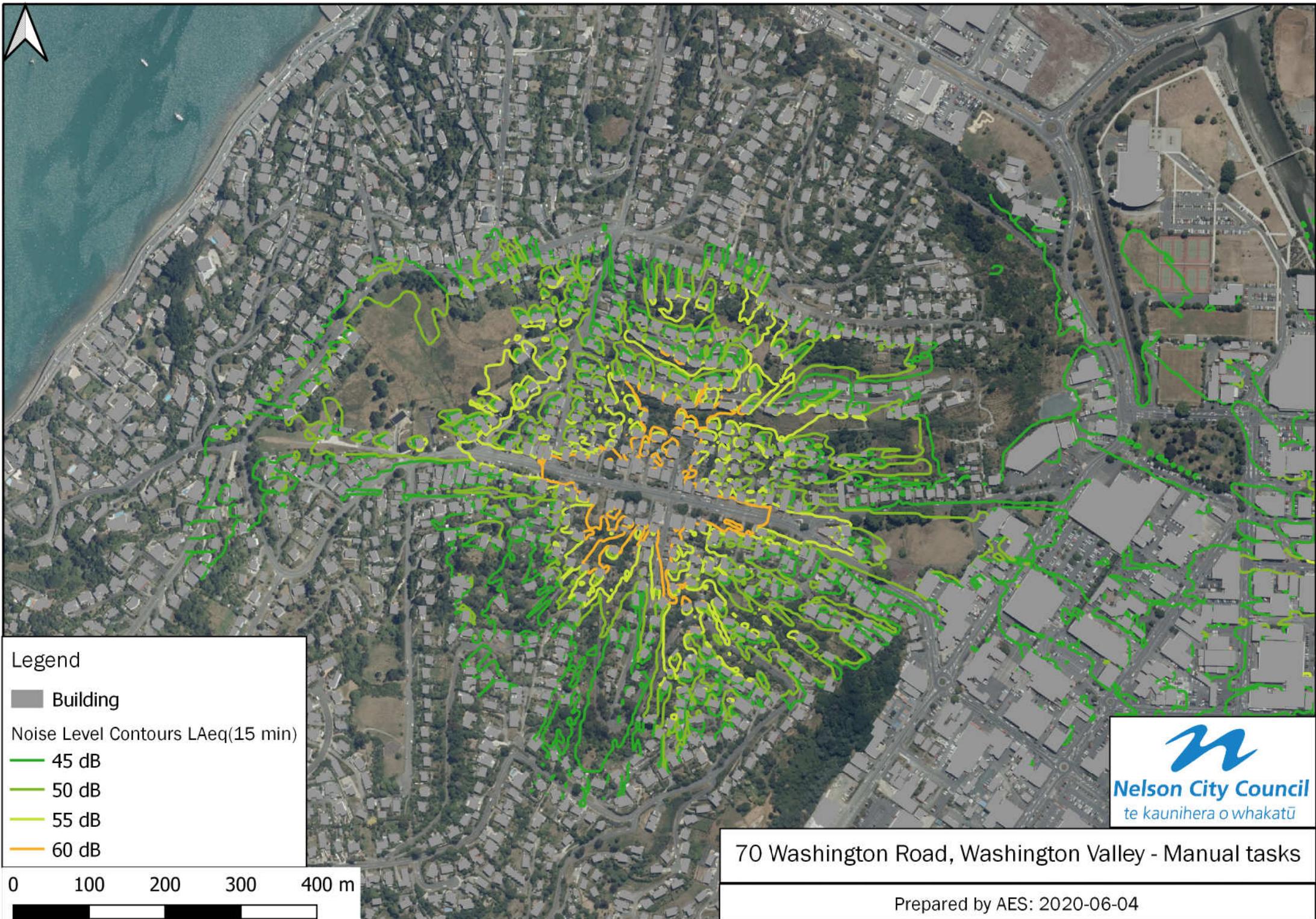
























#### Legend

Building

Noise Level Contours LAeq(15 min)

45 dB

50 dB

55 dB

60 dB

0 100 200 300 400 m



70 Washington Road, Washington Valley - Line marking

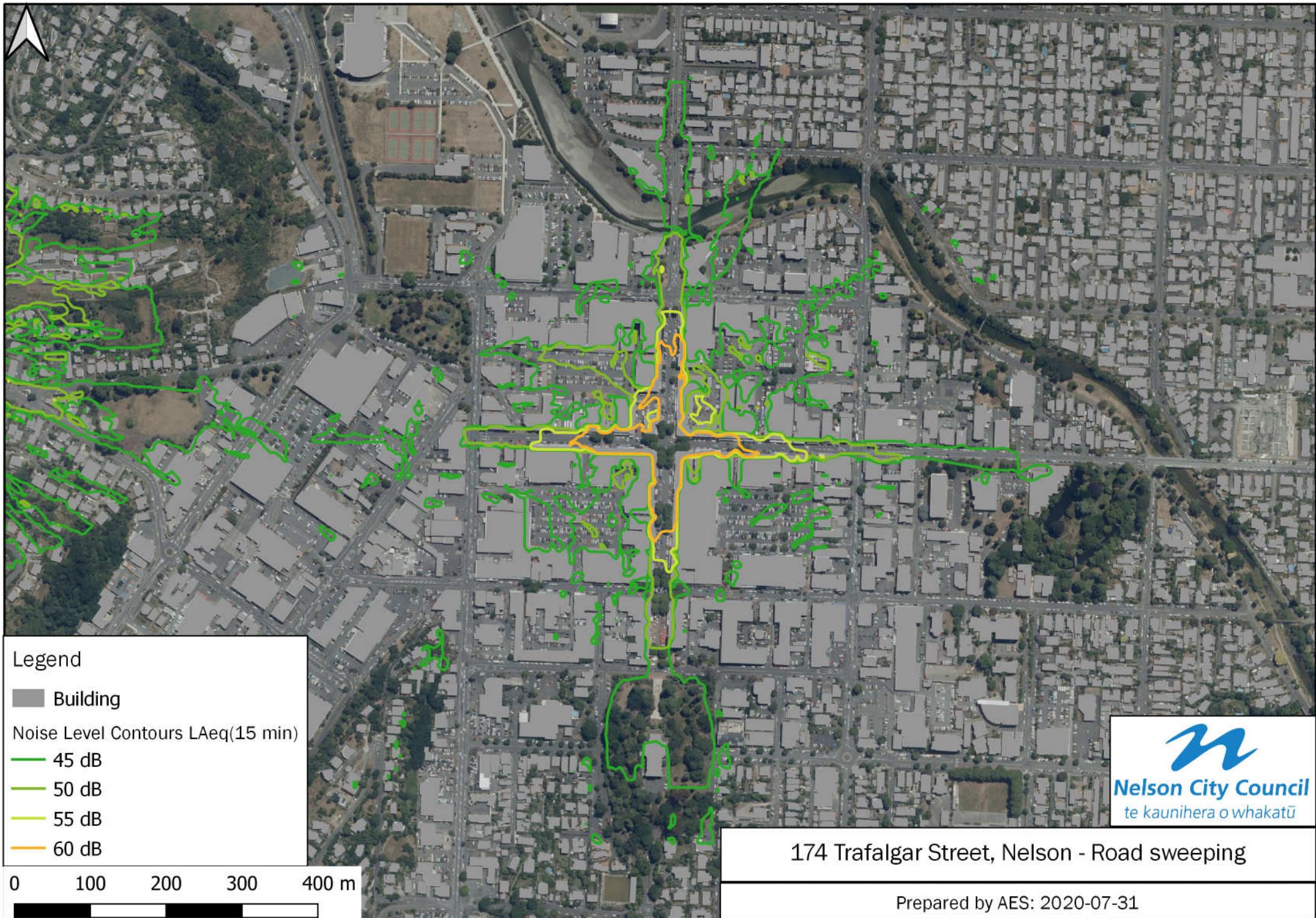
Prepared by AES: 2020-06-04

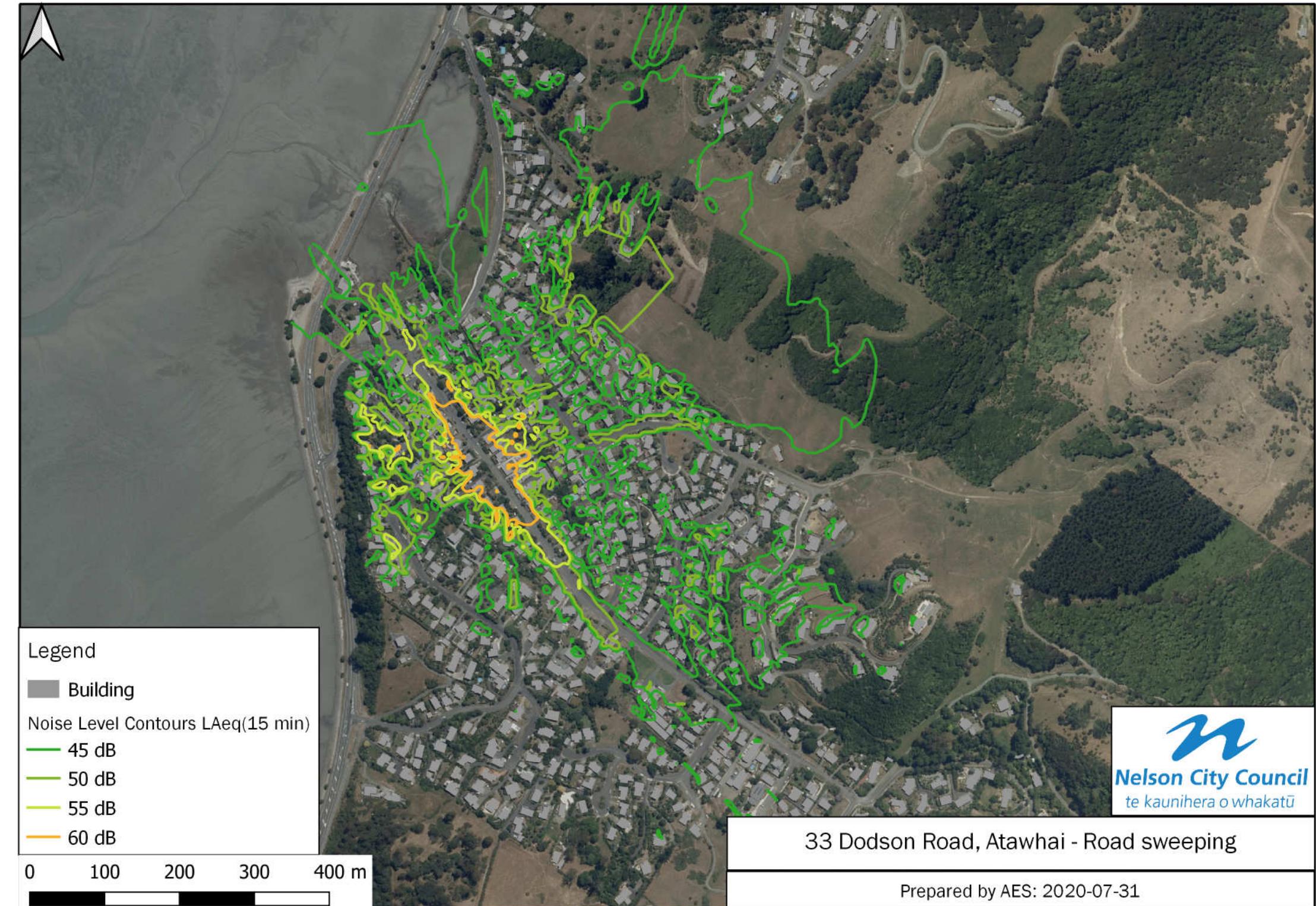


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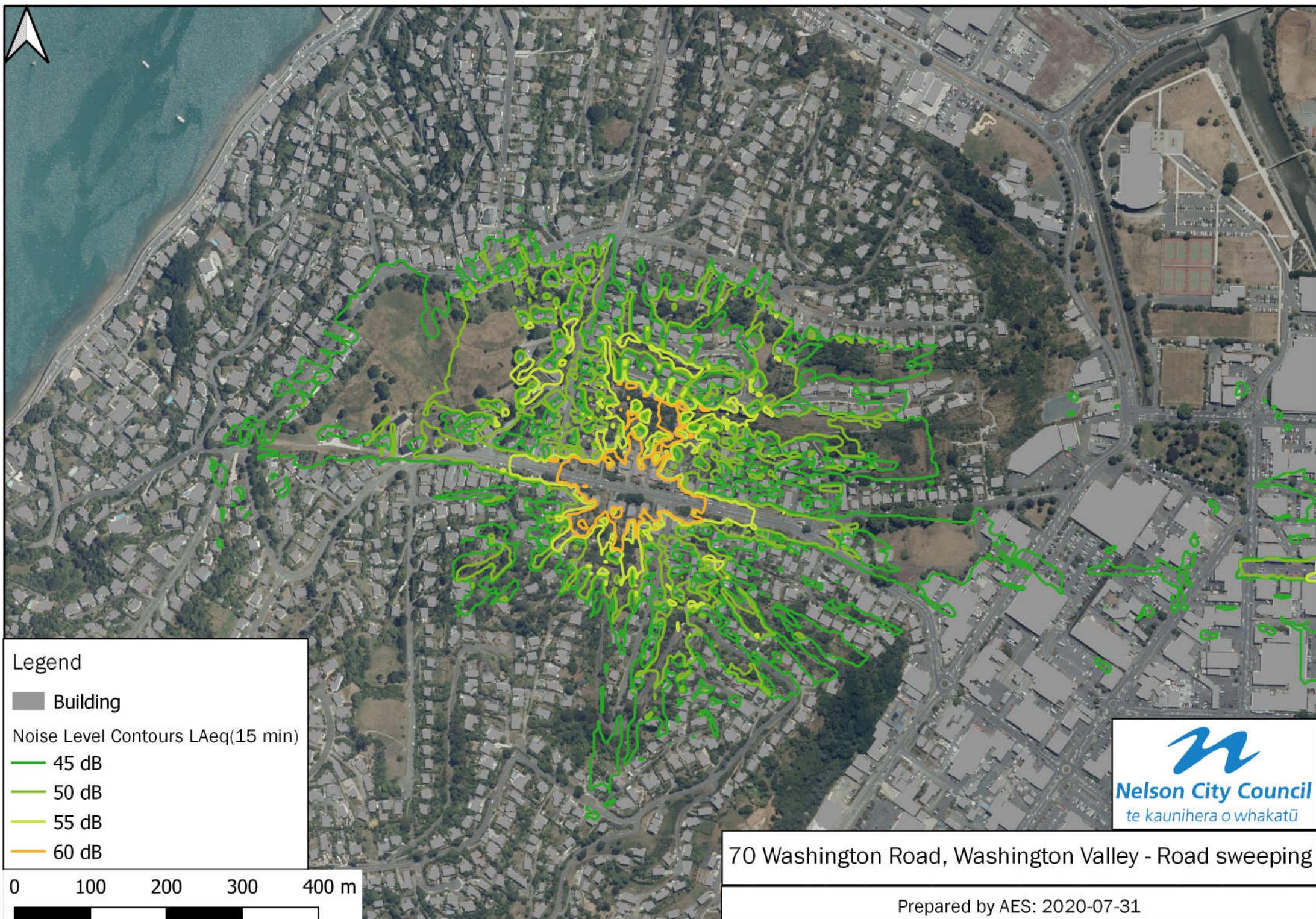












70 Washington Road, Washington Valley - Road sweeping

Prepared by AES: 2020-07-31