Hamilton City Council
Te kaunihera o Kirikiriroa

memo

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City Safe Unit

To:	Andrew Cumberpatch
From:	Peter McGregor – Environmental Health Manager
Subject:	Waikato Regional Theatre - 170 Victoria St – Acoustic and Vibration
Date:	12 September 2019 File:

1. INTRODUCTION

1.1 Resource consent is sought from Hamilton City Council (HCC) by the Waikato Regional Theatre Governance Panel for the establishment of the Waikato Regional Theatre facility at 170-206 and 208-218 Victoria Street, Hamilton Central.

1.2 The proposal includes a 1,300-seat auditorium and associated theatre facilities, a conference centre, hotel and other retail/hospitality tenancies. Construction of the proposal requires, amongst other activities, the following:

- The partial removal of, and external and internal alterations to, the Hamilton Hotel; a 'A' Ranked Built Heritage Item;
- The removal of three Significant Trees;
- Works within Embassy Park to create a large plaza and level access to the main theatre entrance and access to the riverfront promenade; and
- The installation of 5m wide riverfront promenade which will include works within a 'Group 2' Significant Archaeological Site and the Waikato Riverbank and Gully Hazard Area.

1.3 The purpose of this report is to provide a technical review of noise emission and vibration from the proposed activity which will support the section 42A officers report prepared on behalf of HCC.

2. PROPOSAL

2.1 The subject site is in the Central City Zone, and includes a Destination Open Space zone on the north-west boundary (Embassy Plaza) and an adjacent Natural Open Space Zone on the north-east boundary. Beyond this zone is the Waikato River with residential zones further east and north-east based around River Rd and Opoia Rd, and Parana Park and Memorial Park directly to the east across the river.

2.2 The applicant has provided an acoustic assessment by Charcoal Blue (dated November 2018) in support of their application (as Appendix K to the application).

2.3 There are two aspects to consider in relation to noise emission from the proposed activity. These are noise and vibration from construction activity during the construction phase of the project (including the demolition of existing buildings), and operational noise from actual activities and events held on the subject site and from other sources such as mechanical plant, delivery vehicles etc.

2.4 The nearest residentially zoned areas are approx. 240m to the north east on Riro St and approx. 380m to the east on Memorial Dr. Nearby living accommodation in the CBD is at 238 and 240 Victoria St, on the other side of Embassy Plaza from the subject site (the assessment has not identified the latter group as being potentially affected).

3. POLICY CONTEXT

3.1 Policies 25.8.2.1a and 25.8.2.1b from the operative district plan are relevant to this proposal. They are reproduced below.

3.2 Policy 25.8.2.1a states that the amenity values of the surrounding neighbourhood and adjoining activities, especially noise-sensitive activities, shall be protected from the effects of unreasonable noise.

3.3 Policy 25.8.2.1b states that construction, maintenance and demolition activities shall be required to minimise potential adverse effects on the surrounding neighbourhood and adjoining activities.

4. APPLICABLE RULES

4.1 For operational noise the applicable rule is rule 25.8.3.7(a) in relation to residentially zoned areas. This rule prescribes time-dependant noise limits across four time-bands as shown in the table below.

Time of day	Noise level measured in LAeq (15-mins)	Noise level measured in LAF max
0600 – 0700 hours	45dB	75dB
0700 – 2000 hours	50dB	-
2000 – 2300 hours	45dB	-
2300 – 0600 hours	40dB	75dB

4.2 There is no corresponding rule documented in the operative district plan in relation to commercially zoned areas, including in relation to inner city living. However, a reasonable noise limit that has been applied to other inner-city projects and for compliance monitoring purposes is 60dB LAeq.

4.3 Rule 25.8.3.10 applies to noise-sensitive activities such as residential activity within the Central City Zone. It requires these activities to meet internal noise design levels of 35dB

LAeq(24-hr) in bedrooms and 40dB LAeq(24-hr) in all other habitable rooms. Compliance with this requirement is assumed when setting the 60dB noise limit.

4.4 For construction noise the applicable rule is rule 25.8.3.2, which references section 7.2 of NZS6803:1999 'Acoustics – Construction Noise'. Table 2 in that section prescribes noise limits based on the expected duration of construction activity. It is expected that construction activities would take longer than 20 weeks at any location within the greater site. Therefore, the noise limits for 'long-term duration' in Table 2 are the applicable limits for this project.

4.5 For construction vibration the applicable rule is 25.8.3.2, which references the German standard DIN 4150-3:1999 'Structural vibration – Effects of vibration on structures'. This standard prescribes vibration limits for different types of structures and vibration frequencies.

4.6 The noise and vibration limits are incorporated into the list of proposed conditions below (5, 6 and 8). The proposed conditions provide certainty as to what the applicable limits are for both operational and construction noise and vibration, and the reference point for any assessment of noise and vibration levels.

5. SUBMISSIONS RECEIVED

5.1 Eight of the 28 submissions raised noise and vibration from construction and noise from the on-going operation of the proposal as a significant issue.

5.2 The issues raised are summarised under the following headings. I have considered the submissions in my assessment in section 6.

The applicant's acoustic assessment

5.3 It is generally submitted that the acoustic assessment, including the revised version, is inadequate in that it does not assess noise and vibration effects on the inner-city residential apartments at 238 and 240 Victoria St, particularly in relation to construction activity.

5.4 Two of the submitters assert that the measurement location used for the unattended noise survey was inappropriate. Both submitters state that the appropriate location would have been in Embassy Plaza, albeit for different reasons. One submitter considered the plaza location to be better because it would have been noisier and the other because it would have been quieter than the actual location used.

5.5 It is requested that a new acoustic assessment be conducted that assesses noise and vibration effects on the inner-city apartment buildings; and a vibration report on the potential effect on buildings surrounding the subject site.

Noise and vibration from construction

5.6 A major concern that came from submitters residing at 238 and 240 Victoria St is the proposed significant earthworks and uncertainty on the overall nature of the works required within Embassy Plaza, and how this may impact their buildings in relation to potential damage from vibration effects and how these would be managed.

5.7 It appears there is a misconception in one of the submissions that the worst-case scenario of 24-hours referred to in the acoustic assessment applies to construction activity. This is not the case as this was referring to the post-construction on-going operation of the activity. The same submission requests that construction activity be restricted to the hours of 7:00am to 6:00pm. Another requested that the phrase 'during normal hours' for construction be defined.

5.8 It is requested in several submissions that a comprehensive Construction Noise and Vibration Management Plan be developed to address the concerns around noise and vibration effects.

5.9 It is also requested that a pre-condition survey be conducted of the apartment buildings prior to construction commencing to use as a baseline to assess any damage from construction vibration.

Operational noise

5.10 More than one submitter stated that the proposal would increase existing noise levels in the area, including in the residential areas across the river.

5.11 One submitter requested a condition that would require the applicant to install double-glazing to the residential apartments at 238 and 240 Victoria St.

6. ASSESSMENT

6.1 This section discusses the acoustic assessment in relation to noise and vibration from construction activity during the construction phase of the proposal and from the post-construction operation of the proposed activity.

Operational noise

6.2 Based on the information provided in the application and the acoustic assessment, the main sources of potentially problematic noise would be from the auditorium, the rehearsal room, the foyer area and noise associated with deliveries to the site. Other potential sources are mechanical plant and emergency smoke exhaust.

6.3 Noise from the foyer area and from the auditorium has been predicted using standard formulae, firstly to predict the level of noise being emitted from each area, and then to calculate the level of that noise at a certain distant point. The calculations also assume a diffusivity index of 0dB. This is significant as assigning a value to this index results in lower predicted levels of up to 6dB. Therefore, the predicted levels are higher than what they might otherwise have been.

6.4 The calculations are based on information provided in the wider application, such as the design and construction of building elements (for example the use of double glazing in the foyer area). It is to be noted that the intended design and construction of the building seeks to, in part, keep outside noise from entering the building and to prevent the transmission of noise within the building. Both these serve to attenuate the escape of noise from the building.

6.5 In relation to the foyer, an internal noise level of 75dBA has been assumed. The predicted levels are 12dBA and 29dBA in the residential zone and the CBD respectively.

6.6 In relation to the auditorium, an internal noise level of 100dBA has been assumed. The predicted levels are 22dBA and 40dBA in the residential zone and the CBD respectively (the latter based on an assumed 'worst-case' scenario of 30m). For the CBD area, even at the more realistic distance of 20m, the predicted level is 43dBA.

6.7 I have checked the calculations used in the acoustic report to predict the noise levels from the foyer and auditorium at the potential affected receivers and concur with the results. The predicted levels are well within the applicable noise limits stated in section 4 above based on the assumed internal source noise levels. These assumed levels are considered reasonable and have been assumed in other projects.

6.8 For protection from events with a potentially higher adverse effect from low frequency noise I have included frequency-related noise limits in the proposed condition 8 below.

6.9 Noise from the rehearsal room is not expected to be an issue because of the 'box-in-box' construction.

6.10 Deliveries would be made by vehicles accessing the site from Sapper Moore-Jones Pl. Although this activity may comply with the noise limits the noise may still pose a nuisance. I consider that noise from this activity could be managed in accordance with mitigation measures documented in a noise management plan (see below).

6.11 Noise from mechanical services plant and smoke exhaust would be mitigated by well-known design principles applying to these sources, and in any case would be subject to the applicable noise limits.

6.12 The proposed condition 4 would require the provision of a noise management plan for approval by Council. The intention of the Plan is to ensure that the operation of the proposed activity (for example the level of sound generated at source within the theatre, or the sound generated from the delivery area in Sapper Moore-Jones Pl) is such that the applicable standards are complied with. The proposed condition 9 would require compliance with the plan.

6.13 A measurement of the ambient sound level was conducted by the applicant during June 2018. The purpose of this measurement was to establish the level of effects the proposal would have on the existing ambient level. The location of the measurement was such that the recorded level is the lowest in the area, being protected from traffic noise from Victoria St. The ambient level ranged from 47dB LAeq after 11:00pm measured on a Monday night up to 56dB LAeq between 6:00am and 8:00pm measured on a Monday and a Tuesday.

6.14 The maximum level of predicted noise within the CBD is the 40dBA from the auditorium. This would have none to a minimal impact on the existing ambient level in the CBD. Therefore, it is not considered that existing noise levels within the CBD would increase if the proposed activity was consented.

6.15 There is also the issue of noise from people concentrating in Embassy Plaza, either on a casual basis or for an event at the proposed theatre. This issue needs to be assessed

in the context of Embassy Plaza being a Destination Open Space Zone. In this zone a higher level of use and development is anticipated. The related objective and policy relates to the accommodation of a wide variety of uses and values and the enabling of a range of high-quality recreational and community facilities and activities. It is considered that people congregating in the plaza is consistent with the purpose of this zone. In any case it is not expected that people noise would exceed 60dB LAeq.

Construction noise and vibration

6.16 Construction activities would include all aspects commonly associated with a major project, including demolition of existing buildings, earthworks, foundational work (including piling) and the construction of new buildings. Noise would be generated from heavy vehicle movement, plant and equipment and general construction activity. Vibration is also commonly associated with some of these activities. These activities would occur in proximity (as little as 20m) to the residential apartments at 238 and 240 Victoria St.

6.17 The acoustic assessment did not include a detailed assessment of construction noise and vibration. This is because a detailed construction plan and methodology has not yet been developed so it would be difficult to assess effects at this stage. This is considered normal for projects of this scale.

6.18 Construction noise would likely be intrusive. However, the NZS 6803:1999 'Acoustics – Construction Noise' permits higher levels of noise at reasonable times because of the temporary nature of construction activity.

6.19 One of the submitters requested a restriction on the hours of construction activity to be between 7:00am and 6:00pm. Rather than restricting the hours it is proposed to impose (through the proposed condition 5 below) maximum permitted noise limits that apply at different times of the day/night. As stated earlier these proposed time-dependent noise limits are based on those for long-term duration in table 2 in NZS 6803:1999. The highest limit applies between 7:30am and 6:00pm, with the lowest limit applying at night-time (the night-time limit is consistent with the night-time level in residential areas). The lower levels enable the consent holder to carry out quiet construction activity (e.g. inside the completed building envelope).

6.20 Vibration is an expected effect from earthworks and piling. Other construction activities may also produce vibration. The applicant has not addressed this issue at this stage. The Construction Noise and Management Plan proposed in the next paragraph would make the assessment of vibration effects against the German standard a requirement.

6.21 As stated previously, submitters have requested a 'pre-condition survey'. It is considered that such a survey, or assessment of the apartment buildings at 238 and 240 Victoria St prior to construction commencing would be appropriate considering that the nature of these works (including those within Embassy Plaza) and vibration-generating activities have not been described, but could be significant based on the general description of the project and considering that these works would be in immediate proximity to the apartment buildings. The proposed condition 1 would require an assessment of the buildings before construction commences.

6.22 The proposed condition 2 would require the provision of a Construction Noise and Vibration Management Plan (CNVMP) for approval by Council. Such a plan is usually required for large projects and in any case is proposed by the applicant and is requested by the submitters. The elements of the plan as detailed in the proposed condition would provide assurance that the effects of construction noise and vibration, and the mitigation of those effects, have been assessed in relation to the identified likely affected properties. The proposed condition 7 would require compliance with the plan.

6.23 The assessment of noise and vibration effects in the CNVMP would meet the request in submissions for a 'vibration report'. The CNVMP would also require monitoring of sound levels if necessary, and pro-active monitoring of vibration levels from heavier construction activity.

6.24 The CNVMP would need to provide adequate assurance that, if implemented, it would effectively manage noise and vibration from construction activity. Also, Council would need adequate time to review the CNVMP and to agree on any changes with the consent holder before construction begins at the site. These are the reasons for the condition requiring that the CNVMP be prepared by a suitably qualified person in construction noise and vibration, and that the CNVMP be submitted to Council at least 3-months before commencement of construction.

The applicant's acoustic assessment

6.25 It is my view that another acoustic assessment is not required (subject to comments in the next paragraph) as it is considered the assessment provides adequate assurance of compliance in relation to operational noise. A detailed construction methodology is required before construction noise and vibration can be assessed.

6.26 In relation to operational noise, the acoustic assessment relies on the design and construction that is detailed in the application. Any significant change between now and the detailed planning phase may invalidate the acoustic assessment. If changes are likely, or if further assurance is required in relation to noise from mechanical plant, then a better option to requiring a new acoustic assessment would be to add a condition requiring an acoustic design certificate to be provided late in the planning stage showing how the proposed activity would comply with the operational noise limits. I have proposed such a condition (3 below) in the event it is needed.

6.27 It was submitted that the location used for measuring the existing ambient level was inappropriate and not representative of the actual ambient level. Although this may be true in relation to the residential apartments, any measurement in Embassy Plaza would have been higher due to traffic noise from Victoria St and hence it could have been concluded that the effects from the proposed activity would be even less.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 After consideration of the application, the acoustic assessment and submissions received from the notification process, it is my view that noise and vibration can be appropriately managed, and meet the policy objectives recorded earlier, subject to acceptance of the proposed conditions listed below.

7.2 The proposed conditions seek to provide certainty as to the applicable noise and vibration limits, and to provide certainty in relation to the management of construction noise and vibration, and the on-going management of operational noise from the proposed activity.

7.3 I have placed the conditions under the headings used in the applicants proposed conditions.

Peter McGregor
Environmental Health Manager

Pre-commencement conditions

1. An assessment of the condition and susceptibility of the apartment buildings at 238 and 240 Victoria St Hamilton in relation to vibration from construction works shall be completed and documented and forwarded to Council's Planning Guidance Manager at least one month prior to construction work (including earthworks) commencing on the site. The assessment shall be conducted and documented by a suitably qualified and experienced person in construction vibration.

2. A Construction Noise and Vibration Management Plan (which can be part of a larger construction management plan) shall be provided to Council's Planning Guidance Manager for approval at least three months prior to construction work (including earthworks) commencing on the site. The plan shall be prepared by a suitably qualified and experienced person in construction noise and vibration and shall confirm and include the following-

   (a) The applicable construction noise and vibration limits;
   (b) Identification of likely affected properties (off-site), which shall include the residential apartments at 238 and 240 Victoria St Hamilton;
   (c) Predicted noise and vibration levels at the locations of the likely affected properties;
   (d) General methods to mitigate and manage construction noise and vibration to comply with the applicable noise limits;
   (e) Identification of any construction activities (such as pile driving and concrete pours) that may require specific mitigation measures to comply with the applicable noise and vibration limits;
   (f) Provision for sound level monitoring of construction activities that may exceed the stated noise limits;
   (g) A methodology for pro-active monitoring of vibration levels in relation to the residential apartments located at 238 and 240 Victoria St Hamilton to ensure compliance with the stated vibration limits;
   (h) Define the procedures to be followed when construction activities cannot meet the noise and vibration standards in conditions 5 and 6;
   (i) Contact details of the person in charge of construction works;
   (j) A complaint management procedure.

   Advisory note: Refer to Annexes B through to F of NZS 6803:1999 Acoustics – Construction Noise for guidance on the management of construction noise and vibration. There is also a comprehensive list of mitigation measures listed in the application documentation that could be incorporated into the Plan.

3. An acoustic design certificate, prepared by a suitably qualified and experienced person in building acoustics, shall be provided to Council's Planning Guidance Manager at or before the time of application for building consent. The certificate shall show how the noise standards in the previous condition are able to be met in relation to noise from the auditorium, rehearsal room, the foyer and mechanical plant and the smoke exhaust.

4. The consent holder shall provide an Operational Noise Management Plan for approval by Council's Planning Guidance Manager at least three months before commencement of the consented activity. The Plan shall outline the following:

(a) The applicable noise limits;
(b) A description of the types of events and activities that are associated with the consented activity and their location within the consented activity (including the art gallery and the back-of-house delivery/service area);
(c) Identification of potentially affected properties (off-site), which shall include the residential apartments at 238 and 240 Victoria St Hamilton;
(d) Mitigation measures that will be applied to ensure that noise emission from all activities and events will comply with the applicable noise limits;
(e) Contact details of key management personnel;
(f) A complaint management procedure.

Development in progress conditions

5. All construction work on the site, including demolition, earthworks, foundation work, concrete pours and piling, shall be designed and conducted to ensure that construction noise from the site at approximately 1-m from the most exposed façade of a building on any other site in a residential zone, or of a building used for residential accommodation within the Central City Zone, does not exceed the noise limits in the following table. If any sound level measurements are recorded they shall be measured and assessed in accordance with the provisions of NZS 6803:1999 'Acoustics – Construction Noise' by a suitably qualified and experienced person in construction noise -

Time period	**Monday to Friday**		**Saturdays**		**Sundays and Public Holidays**	
	Leq (dBA)	Lmax (dBA)	Leq (dBA)	Lmax (dBA)	Leq (dBA)	Lmax (dBA)
06:30am to 07:30am	55	75	45	75	45	75
07:30am to 06:00pm	70	85	70	85	55	85
06:00pm to 08:00pm	65	80	45	75	45	75
08:00pm to 06:30am	45	75	45	75	45	75

Advisory note: The lower noise limits (shaded) mean that some construction work, particularly in relation to any concrete pours, piling and earthworks, may not be able to take place during the corresponding time frames, which includes all times on Sundays and public holidays.

6. Construction vibration received by any building on any other site shall comply with the vibration limits in the following table. If any monitoring of vibration is required, it shall be conducted in accordance with the German standard DIN 4150-3:1999 'Structural vibration – Part 3: Effects of vibration on structures' by a suitably qualified and experienced person in construction vibration-

Type of Structure	Peak Particle Velocity (mm/s) at the foundation at a frequency of:-			PPV (mm/s) at horizontal plane of highest floor
	1 – 10 Hz	1 – 50 Hz	50 – 100 Hz	
Commercial/Industrial	20	20 - 40	40 - 50	40
Residential/School	5	5 - 15	15 - 20	15
Historic or sensitive structures	3	3 - 8	8 - 10	8

7. All construction works shall be carried out in accordance with the approved Construction Noise and Vibration Management Plan.

Post-development conditions

8. The cumulative noise emission from all events and activities (excluding construction noise) and mechanical plant shall not exceed the rating noise levels in the following tables. Noise levels shall be measured in accordance with NZS6801:2008 'Acoustics - Measurement of Environmental Sound' and assessed in accordance with NZS6802:2008 'Acoustics - Environmental Noise' before comparison with these levels-

   (a) At any point within the boundary of any other site in a residential zone-

Time of day	**Noise level measured in LAeq (15-min)**	**Noise level measured in LAFmax**
0600 – 0700 hours	45dB	75dB
0700 – 2000 hours	50dB	-
2000 – 2300 hours	45dB	-
2300 – 0600 hours	40dB	75dB

   (b) At any point 1 metre from the external facade of any building in the Central City Zone (including those used for residential activity or for visitor accommodation)-

Time of day	**Noise level measured in LAeq (15-min)**	**Noise level measured in LAFmax**
At all times (24-hrs)	60dB	75dB
	55dB @ 63Hz	

	50dB @ 125Hz	

9. All events and activities associated with the consented activity shall be managed in accordance with the approved Operational Noise Management Plan.