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St Leonards Health Organisation Relocation (SHOR)

Noise and Vibration Management Plan

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1 INTRODUCTION

This report presents a review of potential noise and vibration impacts as a result of proposed the demolition, excavation and construction of the new St Leonards Health Organisation Relocation (SHOR) project in St Leonards. The project site is located with the Royal North Shore Hospital Grounds.

When assessing noise and vibration impacts, the following EPA guidelines will be considered:

- For airborne noise, the NSW EPA *Construction Noise Guidelines*.
- For vibration, the NSW EPA document – *Assessing Vibration, a technical guideline*.

2 SITE DESCRIPTION AND PROPOSED WORKS

The area of site works proposed as part of the SHOR development is broken into two phases; phase 1 includes site establishment/soft strip out and phase 2 includes structural demolition, excavation and construction. The two phases have been discussed in further detail below.

Phase 1 – Site Establishment and Soft Strip out – Figure 2-1 and Figure 2-2

Noise sensitive development in the vicinity of the SHOR development during phase 1 consists of the following:

- Receiver 1 - Building 31 located to the north. Building 31 (or Vanderfield Building) is used as a teaching hospital as part of Royal North Shore Hospital.
- Receiver 2 - Building 35 and Building 36 located to the east. Building 35 contains medical offices and building 36 is used for Radiation Oncology.
- Receiver 3 - Building 38 is located to the south east. Building 38 is currently being used as a Child Care Centre, until its new location is completed east of building 36. The existing outdoor play area is located east of the existing building 38 facade.
- Receiver 4 - Commercial buildings located at 207 and 207A Pacific Highway St Leonards located along the southern boundary of the site.
- Receiver 5 – Residential building located at 3 Herbert Street, St Leonards located to the east of the site across Herbert Street.

An aerial site location and receiver locations map has been provided below.

Works which will be undertaken during phase 1 include the following;

- Installation of temporary site fence (similar to ATF fencing).
- Installation of temporary site accommodation.
- Internal strip out of buildings 34, 51 and 52.
- Vehicle travel paths will access the site via Reserve Road.

Acoustic Logic has been advised that there are no in-patient rooms which face the project site in any of the adjoining buildings.

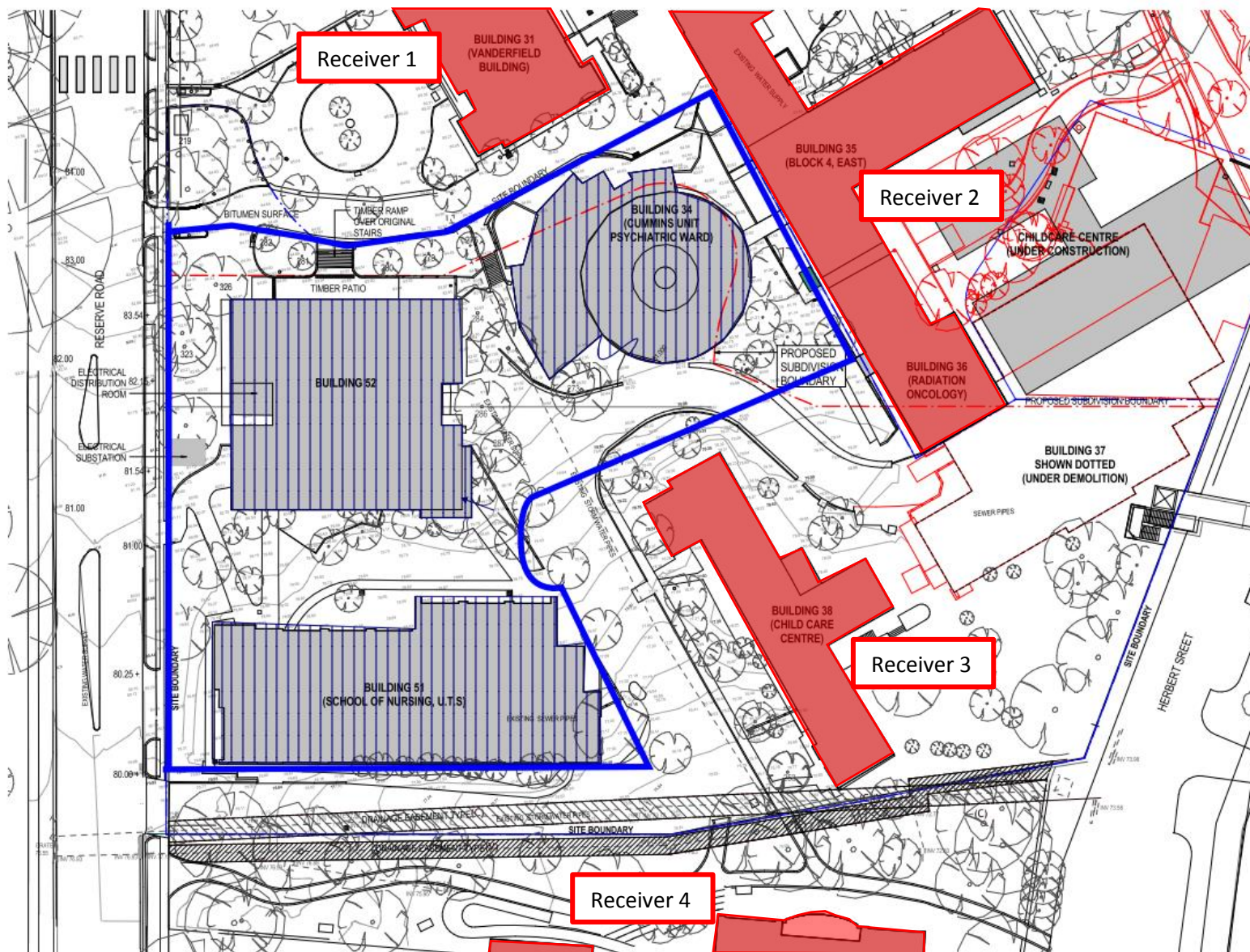


Figure 2-1: Site Survey and Sensitive Receiver Locations – Phase 1

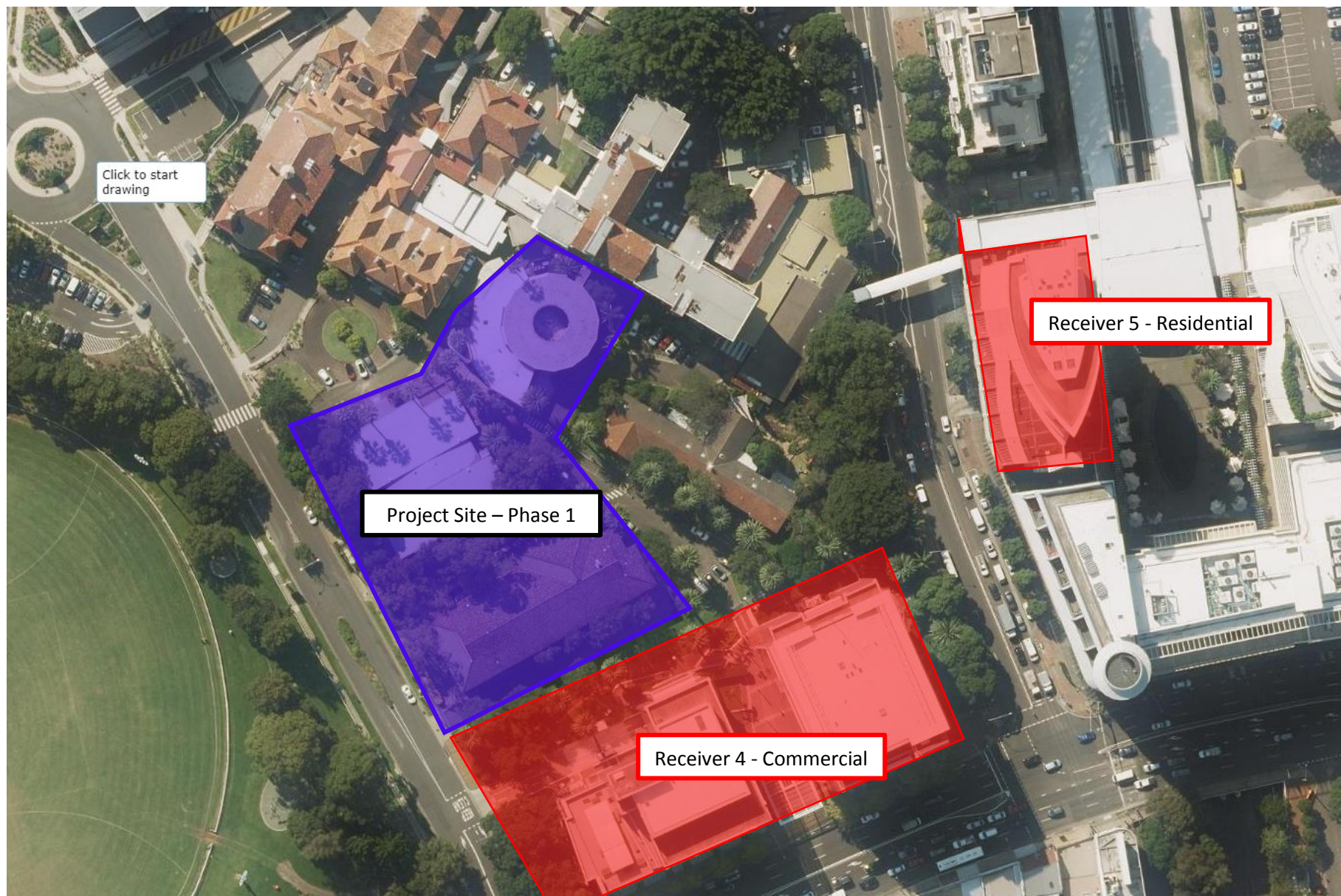


Figure 2-2: Site Survey and Sensitive Receiver Locations – Phase 1

Phase 2 – Structural Demolition, Excavation and Construction – Figure 2-2

Noise sensitive development in the vicinity of the SHOR development for phase 2 consists of:

- Receiver 1 - Building 31 located to the north. Building 31 (or Vanderfield Building) is used as a teaching hospital as part of Royal North Shore Hospital.
- Receiver 2 - Building 35 and Building 36 located to the east. Building 35 contains medical offices and building 36 is used for Radiation Oncology.
- Receiver 4 - Commercial buildings located at 207 and 207A Pacific Highway St Leonards located along the southern boundary of the site.
- Receiver 5 – Residential building located at 3 Herbert Street, St Leonards located to the east of the site across Herbert Street.

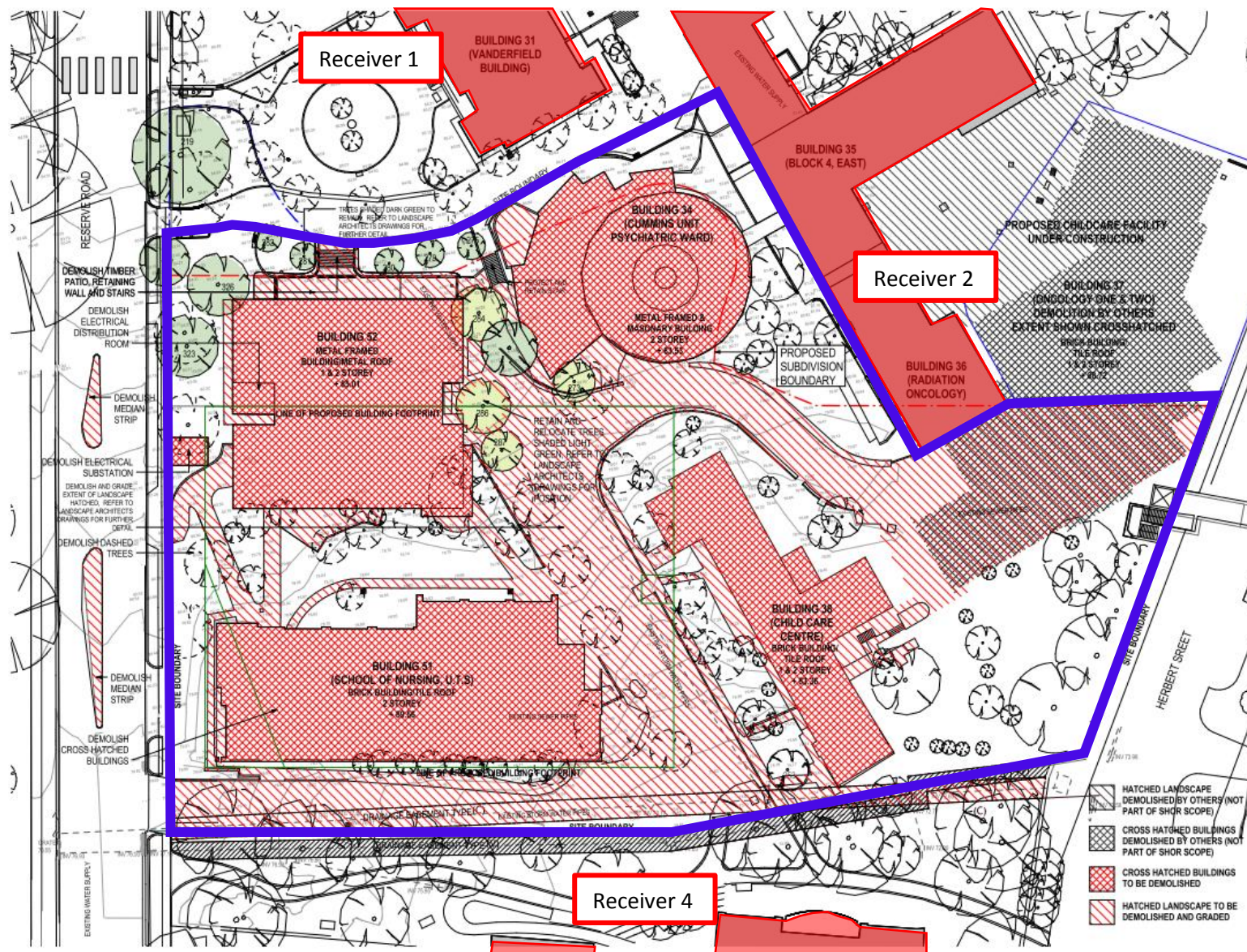
Note: As part of the phase 2 works, receiver 3 (building 38 – existing Child Care Centre and Building 37) will be demolished and included into the site compound, therefore noise emissions to this building have not been conducted.

An aerial site location and receiver locations map has been provided below.

Works which will be undertaken during phase 2 include the following;

- Structural demolition of buildings 34, 37, 38, 52 and 53.
- Excavation of two basements levels to form the new car parking and building services area of the SHOR development.
 - During the excavation works, installation of bored foundation piers will be undertaken.
 - Post bulk excavation, detailed excavation of pile caps will occur.
- Construction of a 10-storey commercial office building structure.
- Internal fit out as required (post installation of façade).
- Electric crane and two Alimaks be installed along the eastern façade of the proposed building.
- Vehicle travel paths will access the site via Reserve Road.

Acoustic Logic has been advised that there are no in-patient rooms which face the project site.



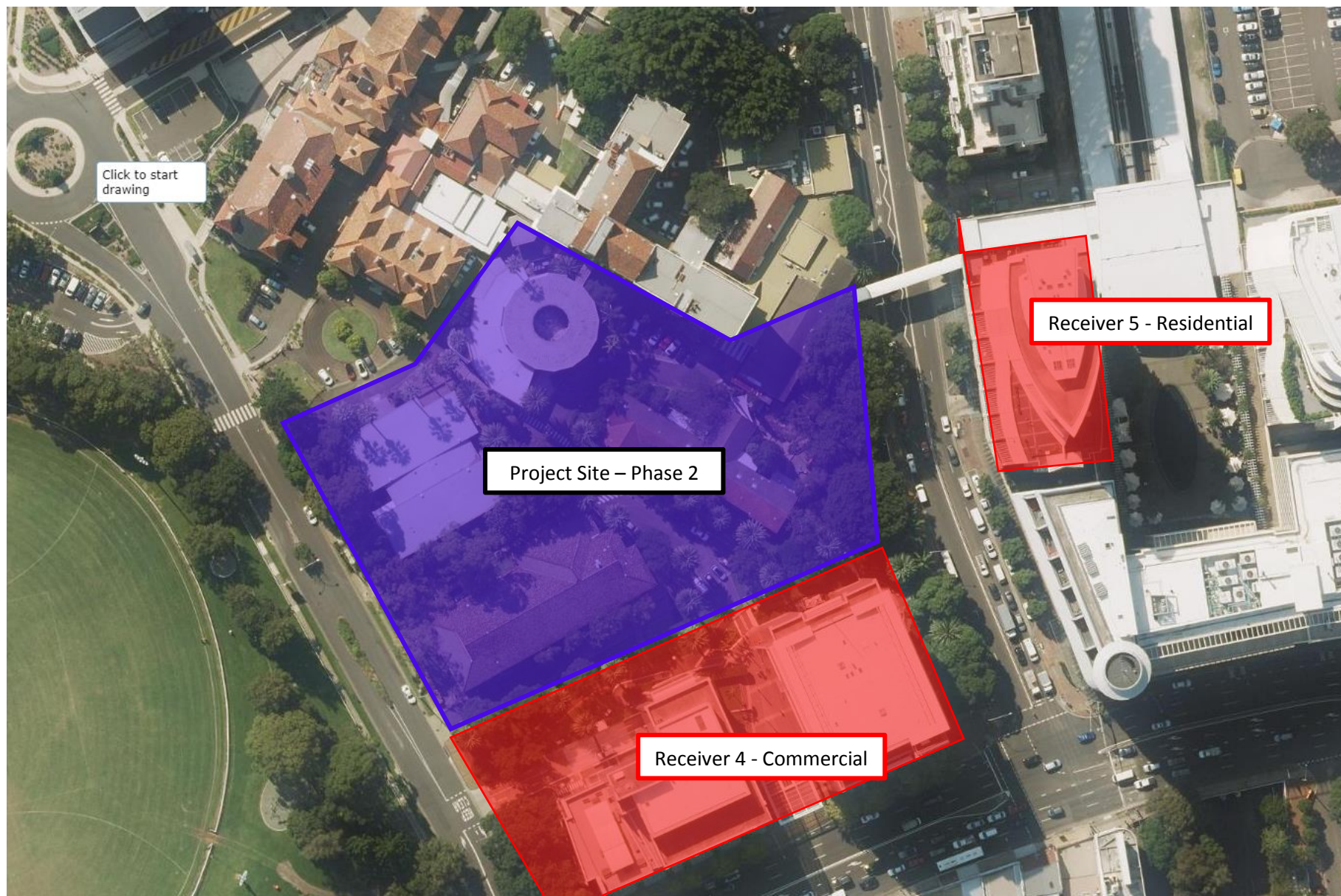


Figure 2-4: Site Survey and Sensitive Receiver Locations – Phase 2

3 ACOUSTIC CRITERIA

3.1 NOISE

3.1.1 Noise Emission Guidelines - EPA Interim Construction Noise Guidelines (ICNG)

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *“Noise affected” level.* Where construction noise is predicted to exceed the “noise effected” level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the “noise effected level”. For residential properties, the “noise effected” level occurs when construction noise exceeds ambient levels by more than $10\text{dB(A)}_{\text{Leq}(15\text{min})}$.
- *“Highly noise affected level”.* Where noise emissions are such that nearby properties are “highly noise effected”, noise controls such as respite periods should be considered. For residential properties, the “highly noise effected” level occurs when construction noise exceeds $75\text{dB(A)}_{\text{Leq}(15\text{min})}$ at nearby residences.

Ambient noise levels at Herbert Street were determined based on site noise measurements and found to be $53\text{dB(A)}_{\text{L}_{90}}$.

A summary of target noise levels is presented below. If these noise levels are likely to be exceeded, reasonable and feasible noise management strategies will be proposed.

Table 1 – Noise Emission Goals – Residential - External

Location	“Noise Affected” Level (Background+10dB(A)) $\text{dB(A)}_{\text{Leq}(15\text{min})}$	“Highly Noise Affected” Level - $\text{dB(A)}_{\text{Leq}(15\text{min})}$
Residential Development	63	75

We note:

- For teaching spaces, the EPA Construction Noise Guidelines recommend that noise levels from construction activities not exceed 45dB(A) (Internally).
- For commercial buildings, the EPA Construction Noise Guidelines recommend that noise levels from construction activities not exceed 70dB(A) (Externally).
- For working laboratory and office areas, the EPA Construction Noise Guidelines do not outline specific acoustic requirements. In order to determine a reasonable noise goal for these spaces:
 - Australian Standard 2107 is a commonly used standard for assessing noise levels in internal spaces. AS2107 however, is for permanent, steady noise sources (HVAC noise/traffic noise) and not temporary noise such as from construction work.

- A reasonable guideline for assessing construction noise is to add a further 5dB(A) to the AS2107 recommended noise level.

Noise emission goals for construction noise are as follows:

Table 2 – Noise Emission Goals – Internal Areas

Space Type	AS2107 Noise Level dB(A) _{Leq}	Construction Noise Goal dB(A) _{Leq}
Office Space	40-45	50
Working Laboratory	40-50	55
Teaching Spaces	N/A	45

In the event that noise emissions exceed these levels, mitigation treatments are recommended.

3.2 VIBRATION

Demolition/construction works are unlikely to create vibration with the potential for building damage.

Primary vibration impact is therefore the potential for impact on the amenity of users.

Vibration goals are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels are presented below:

Table 3 – Demolition Vibration Goals

Location	Time	RMS acceleration (m/s2)	
		Preferred	Maximum
Continuous Vibration			
Teaching Spaces	When in use	0.02	0.04
Offices (Interview/Office/Tutorial)	When in use	0.02	0.04
Working Laboratory	When in use	0.01	0.02
Impulsive Vibration			
Teaching Spaces	All times	0.64	1.28
Offices (Interview/Office/Tutorial)	When in use	0.64	1.28
Working Laboratory	All times	0.3	0.6

4 NOISE EMISSION ASSESSMENT/RECOMMENDATIONS

4.1 PREDICTED CONSTRUCTION NOISE LEVELS

Noise from the worst-case construction works for each phase of the development have been predicted to the nearest most affected sensitive receivers. The predicted noise levels are presented in this section.

The following presents the predicted noise levels for each item of typically louder plant. Noise has been predicted to surrounding sensitive uses. The loudest typical appliance for each phase has been included. Predicted noise levels in the table below are presented based on the following:

- Predicted noise levels to commercial receivers are presented as internal noise levels.
- Predicted noise levels to working laboratory receivers are presented as internal noise levels.
- Predicted noise levels to residential receivers are presented as external noise levels.
- Internal noise levels have been predicted based upon the expected noise reduction from the façade system of the predicted receiver location.
- Based on our site inspection we have identified to be two types of façade systems surround the site.
 - (a) Façade systems which have an estimated external to internal reduction of 20dB(A).
 - (b) Façade systems which have an estimated external to internal reduction of 25dB(A).
- The following table presents the assumed acoustic performance of each receiver.

Table 4 – Receiver Façade Systems

Receiver	External and Internal Reduction dB(A)
Receiver 1 (Building 31)	20
Receiver 2 (Building 35 & 36)	20
Receiver 3 (Building 38)	20
Receiver 4 (207 and 207A Pacific Highway St Leonards)	25
Receiver 5 (3 Herbert Street, St Leonards)	N/A*

*Predictions will be made to the façade of the receiver.

Plant noise predictions have been broken up into two phases as per the site works which be undertaken. In assessment of noise emissions, the overall cumulative noise level is typically dominated by the noise level of the loudest equipment item. The noise levels predicted in the tables below are cumulative, but are primarily a result of loudest equipment item(s), as identified in the “Activity” column in the tables below.

4.1.1 Phase 1 - Site Establishment and Soft Strip out

Predicted noise levels from the site establishment works and soft strip out are presented below.

Table 5 – Noise Emission Assessment – Receiver 1 (Building 31)

Activity	Predicted Level at Receiver – dB(A)L_{AvMax} (Internal Areas)	Comment
Trucks	<45dB(A)	Complies with Noise Management Level.
Hand Tools (Internal Works)	<45dB(A)	Complies with Noise Management Level.

Table 6 – Noise Emission Assessment – Receiver 2 (Building 35 & 36)

Activity	Predicted Level at Receiver – dB(A)L_{AvMax} (Internal Areas)	Comment
Trucks	<45dB(A)	Complies with Noise Management Level.
Hand Tools (Internal Works)	<45dB(A)	Complies with Noise Management Level.

Table 7 – Noise Emission Assessment – Receiver 3 (Building 38)

Activity	Predicted Level at Receiver – dB(A)L_{AvMax} (Internal Areas)	Comment
Trucks	<45dB(A)	Complies with Noise Management Level..
Hand Tools (Internal Works)	<45dB(A)	Complies with Noise Management Level.

Table 8 – Noise Emission Assessment – Receiver 4 (207-207A Pacific Highway, St Leonards)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (External Areas)	Comment
Trucks	<70dB(A)	Complies with Noise Management Level.
Hand Tools (Internal Works)	<70dB(A)	Complies with Noise Management Level.

Table 9 – Noise Emission Assessment – Receiver 5 (3 Herbert Street, St Leonards)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (External Facade)	Comment
Trucks	<63dB(A)	Complies with Noise Management Level.
Hand Tools (Internal Works)	<63dB(A)	Complies with Noise Management Level.

4.1.2 Phase 2 - Structural Demolition, Excavation and Construction

Predicted noise levels from the structural demolition, excavation and construction out are presented below.

Table 10 – Noise Emission Assessment – Receiver 1 (Building 31)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (Internal Areas)	Comment
Demolition – Dozer (Façade Removal)	<45-65dB(A)	Exceeds Noise Management Level
Demolition – Hydraulic Hammer (If required for ground floor slab)	55-73dB(A)	Exceeds Noise Management Level
Excavation (ripping and bucket use)	<45-63dB(A)	Exceeds Noise Management Level
Power Tools (Hand Tools)	<45-47dB(A)	Intermittence Exceedance. During close proximity works.

Table 10 – Noise Emission Assessment – Receiver 1 (Building 31) (Cont.)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (Internal Areas)	Comment
Trucks	<45-49dB(A)	Intermittence Exceedance. During close proximity works.
Alimak	<45dB(A)	Complies with Noise Management Level.
Concrete Pumping	47dB(A)	Exceeds Noise Management Level

*Assumes that any localised connection between buildings are removed prior to commencement of works.

Table 11 – Noise Emission Assessment – Receiver 2 (Building 35 & 36)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (Internal Areas)	Comment
Demolition – Dozer (Façade Removal)	<45-62dB(A)	Exceeds Noise Management Level
Demolition – Hydraulic Hammer (If required for ground floor slab)	52-72dB(A)	Exceeds Noise Management Level
Excavation (ripping and bucket use)	<45-62dB(A)	Exceeds Noise Management Level
Power Tools (Hand Tools)	<45-46dB(A)	Intermittence Exceedance. During close proximity works.
Trucks	<45-49dB(A)	Intermittence Exceedance. During close proximity works.
Alimak	<45dB(A)	Complies with Noise Management Level.
Concrete Pumping	53dB(A)	Exceeds Noise Management Level

Note: During structural demolition, excavation and construction stage receiver 3 would have been handed over from the client.

Table 12 – Noise Emission Assessment – Receiver 4 (207-207A Pacific Highway, St Leonards)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (External Facade)	Comment
Demolition – Dozer (Façade Removal)	<70-74dB(A)	Marginal Exceedance.
Demolition – Hydraulic Hammer (If required for ground floor slab)	<70-84 dB(A)	Exceedance with Noise Management Level.
Excavation (ripping and bucket use)	<70-74 dB(A)	Marginal Exceedance.
Power Tools (Hand Tools)	<70dB(A)	Complies with Noise Management Level.
Trucks	<70dB(A)	Complies with Noise Management Level.
Alimak	<70dB(A)	Complies with Noise Management Level.
Concrete Pumping	<70dB(A)	Complies with Noise Management Level.

Table 13 – Noise Emission Assessment – Receiver 5 (3 Herbert Street, St Leonards)

Activity	Predicted Level at Receiver – dB(A)_{L_{Av}Max} (External Facade)	Comment
Demolition – Dozer (Façade Removal)	<63dB(A)	Complies with Noise Management Level.
Demolition – Hydraulic Hammer (If required for ground floor slab)	<63dB(A)	Complies with Noise Management Level.
Excavation (ripping and bucket use)	<63dB(A)	Complies with Noise Management Level.
Power Tools (Hand Tools)	<63dB(A)	Complies with Noise Management Level.
Trucks	<63dB(A)	Complies with Noise Management Level.
Alimak	<63dB(A)	Complies with Noise Management Level.
Concrete Pumping	<63dB(A)	Complies with Noise Management Level.

4.2 ACOUSTIC LOGIC RECOMMENDATIONS

Based on the predicted noise levels above, the following mitigation measures are proposed.

- Prior to any works on site all structural ties between the project buildings and surrounding receivers should be removed to minimise structure borne noise. This can be achieved using a saw cutting technique.
- During the soft strip-out it is recommended that the existing façade of the project buildings be retained as much as possible. As the existing facades will provide some noise reduction.
- It is recommended that an electric type crane be used in lieu of a diesel crane.
- Structural demolition and excavation will produce moderate to high level of noise (moderate exceedance for dozer, ripping, high exceedance during use of pneumatic hammer). Structural demolition is anticipated to take 3 months and ground floor slab removal is anticipated to take 2 weeks. ALC has explored the option to utilise alternate methods for each of these tasks, however unavailable. Therefore, we recommend the following:
 - Written notice to Health Infrastructure should be undertaken prior to any works commencement to assist in scheduling moves or critical meetings around proposed works. This should include dates, duration and works location.
- It is recommended that the use of the pneumatic hammer should be minimised as much as practical.
- In the event concrete pumping is located adjacent to buildings 31, 35 and 36, an exceedance of the 50dB(A) guideline will occur. Therefore, it is recommended that prior to the commencement of concrete pours notification should be given to the occupants.
- During demolition of the ground floor slab and the excavation period vibration monitoring is recommended at nearest points at building 35 and building 31.
 - The monitors will have SMS capability, so that Acoustic Logic, Multiplex and the demolition contractor can receive immediate notification in the event that trigger levels are reached.
- If practicable, during the same period it is recommended that a noise monitor should be installed with in building 35. The exact location of the noise monitor will be determined prior to the installation once layout of Building 35 is known.
 - Any exceedances above the noise goals will be identified in report summarising the results of the monitoring period.

5 CONCLUSION

This report provides the results of an assessment of noise and vibration from the proposed demolition, excavation and construction of the St Leonards Health Organisation Relocation (SHOR) project in St Leonards.

Noise emissions have been assessed with reference to applicable EPA noise and vibration emission guidelines.

Provided that the recommendations set out in section 5 of this report are adopted, noise and vibration impacts will be mitigated as much as practicable, and end users will be given notice of potential impacts.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Matthew Furlong', with a large, sweeping flourish at the end.

Acoustic Logic Consultancy Pty Ltd
Matthew Furlong