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DARWIN WHARF PRECINCT REDEVELOPMENT

NOISE ASSESSMENT

FOR

URS AUSTRALIA

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NOISE IMPACT ASSESSMENT

SVT were commissioned by URS Australia to undertake an acoustic assessment of the proposed Darwin Wharf Precinct Redevelopment, located on the Darwin Harbour, Darwin.

At the time of writing, a developer had not been appointed for the project, and only an outline of the development's possible scope was available. This report will be continually updated to reflect the level of information available at the time of writing.

1.1 Objectives and Scope

The acoustic assessment aims at highlighting the potential noise impact of the proposed development on the surrounding environment, and the effect that the surrounding environment may have upon the development's use. The acoustic assessment additionally intends to highlight any likely noise impact within the development's boundary, resulting from the interaction of facilities and land uses proposed.

Recommendations concerning possible mitigation measures, reducing the likely noise impact of the development, are provided within this report.

The following outlines the major activities required to be undertaken during the course of this study:

- Review the development's proposals, including:
 - Architect and/or developer drawings
 - Types of usages proposed
 - Entertainment
 - Marine
 - Residential
 - Commercial
 - Facility construction/s and the associated acoustic properties
 - Road traffic paths
- Contact the Darwin Department of Infrastructure and Planning to establish noise requirements
- Review noise impacts
 - From the development's use on existing, surrounding environment
 - From the surrounding environment on the developments' use/s
 - Between facilities/uses proposed within the development
 - From traffic on both development and existing environment
 - Review and compare current and future traffic predictions
- Provide recommendations to reduce any noise impact, regarding:
 - The development's layout
 - Layout of mechanical equipment likely to be included within the development

Due to the limited detail available regarding the development's scope, many of the above aspects are not included within this report revision.

1.2 Description of the Existing Environment

Acting as the primary wharf for the city of Darwin since European settlement (1869), the area has until recently developed its industrial focus. However, the expansion of the Darwin CBD and requirement for improved wharf facilities, has sparked the development of alternative wharf facilities. "With the opening of the new Darwin East Arm Port, much of the industry previously functioning on this land *(Darwin Wharf)*, has now ceased or moved to new locations. Use of the wharves has now contracted from its earlier port functions to servicing the needs of smaller vessels, cruise liners and naval requirements."¹

The above mentioned changes in activities within the wharf suggest that current noise levels generated within the wharf precinct will have reduced correspondingly. Previously noise from loading conveyors, marine vessel noise, transportation vehicles, processing plant etc is expected to have dominated the noise climate of the area, with surrounding buildings impacted accordingly. The current more commercial focus of the wharf precinct (*for smaller vessels and cruise liners*), is expected to have resulted in lower ambient noise levels associated with activities within the wharf area. The expansion of the Darwin CBD, however, is expected to generate increased daytime noise levels to the north of the wharf area.

In order to verify the existing background noise level on the proposed development site, SVT have conducted a noise survey, with both detailed event noise level measurements, and 24-hour noise monitoring conducted.

1.2.1 Background Noise Levels

Previous noise surveys conducted nearby the proposed development site have provided some insight into the existing (current) level of background and ambient noise within the area. Background noise levels at the northern boundary of the development site (near The Esplanade - top of escarpment) are known to fluctuate between approximately L_{90} 45 – 55dB(A) throughout the daytime hours, reducing to a typical minimum of L_{90} 35 – 40dB(A) throughout the early morning hours (data calculated over 15-minute sampling periods).

A 24-hour noise monitoring survey was conducted between 18:00 on the 27th April and 18:00 hours on the 28th April 2004. The level of activity, and hence corresponding noise levels, was believed to be typical for that area. The noise information obtained is shown overleaf in graphical format within figure 1. The graph shows the daytime typical background noise levels of between L_{A90} 45dB and 51dB, reducing to an overnight minimum of L_{A90} 42dB. Based on additional background noise information of the area, we believe a noise level of L_{A90} 40dB(A) represents a more typical night-time minimum, and should be used as the basis of further assessment.

The daytime noise levels are influenced by boat movements within the Darwin Wharf, with event level measured as discussed in section 1.2.2. These levels are recommended to be used in future assessments, assisting in the development of site specific noise limits.

¹ Northern Territory Government, Darwin City Waterfront Invitation for Expression of Interest document. (Section 2)

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Figure 1 – Background noise monitoring 27th – 28th April 2004.



1.2.2 Event Noise Levels

Area specific events are known to contribute to the area's current/existing noise climate.

Activities at the Iron Ore Wharf, Fort Hill operations and Stokes Hill Wharf are believed to generate varying levels of noise associated with their operation/s. Currently we are aware of the following port usages and available facilities:

Iron Ore Wharf

- Berthage for bulk liquids vessels (including navy fuel, petrol, diesel, and jet fuel).
- Connected by a network of pipelines to the Navy Fuel Installation and Stuart Park Tank Farm.
- Secure berthage for Defence.
- Flow over of operations from East Arm.

Fort Hill

- Cargo and bulk liquids handling.
- Berthage for general cargo vessels (operation is being progressively phased out to East Arm Port with phase out expected to be completed by 2004-05).
- Secure berthage for Defence & cruise ships.
- Incorporates Roll On Roll Off (RoRo) facility that is used primarily by Defence, but also cruise and commercial vessels.
- Flow over of operations from East Arm Port.
- Connected by a network of pipelines to the Navy Fuel Installation and Stuart Park Tank Farm.
- Licensed as a Customs holding area.

Stokes Hill Wharf

- Retail Arcade and former Cruise Ship Terminal used for tourism, recreation and entertainment purposes. A popular location for locals for fishing and dining.
- Berthage for smaller commercial vessels, research vessels and pleasure craft. Wharf does not have the structural capacity to facilitate berthing of larger vessels.
- Flow over of operations from East Arm, Iron Ore, Fort Hill, Fisherman's Wharf and the Mooring Basin.
- Bunkering facilities.
- Quarantine areas managed by the Commonwealth's Australian Fisheries Zone Compliance (AFMA) and Customs.
- Berthage for Customs vessels.

The contribution of the above events to the noise levels received on the development site, will vary according to the separation distance and the level of noise generated at the facility.

In addition to the 24-hour noise monitoring completed, SVT have also conducted a further noise survey in order to attain details of the existing noise levels on site, resulting from Wharf activities. The survey was conducted on the 27th April 2004. It is understood, through a conversation with the Port of Darwin Supervisor, that the movements of fishing vessels and possible unloading of cargo (fish etc.) were the only activities expected on that particular day. Noise measurements relating to these tasks were hence obtained. It should be noted that the wind throughout the noise

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survey was blowing directly on-shore, providing worst case noise propagation from potentially impacting noise sources both within the harbour and on the shoreline.

Fishing vessels moored at the Stokes Hill Wharf, with their engines operating at idle (75dBA at 3m), generated noise audible over the majority of the shoreline, across the water (approximately 100m - 200m away from the wharf). A noise level of L_{eq} 55dB(A) was measured at the water's edge, near the proposed location of residential accommodation.

No unloading of vessels was witnessed throughout the noise survey. It is feasible to expect that impacts resulting from such activities may result in short durations of noise exceeding that of the fishing vessel motors at idle.

The use of a crane near the Port of Darwin Offices (central shoreline location within wharf) was witnessed throughout the survey and measured at L_{eq} 55dB(A) approximately 100 meters inland of the shoreline operation. Noise treatments and/or operational restrictions may be required for such activities where this is likely to continue once residential premises are present within the development site.

Details of the exact services to be provided throughout the wharf precinct upon commencement of the development, and associated port activities, are at this stage undefined. It should be expected that noise will currently exist throughout concentrated regions of the development area as illustrated by the noise survey conducted. Figure 2 overleaf shows the expected noise contours resulting from those activities highlighted above. The need for noise mitigation measures is then discussed within section 1.4.

Noise impacts from wharf activities further to that outlined above are not expected, with specific acoustic treatments not expected to be required for the reduction of such levels.

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Figure 2 Noise Contours from typical wharf events.

_____ 55dB(A) noise contour resulting from fishing vessels at idle at the wharf.

55dB(A) noise contour resulting from operation of crane within wharf.



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1.3 Description of the Proposed Development

The project aims to redevelop the existing Darwin Wharf Precinct from its current state to incorporate a Convention and Exhibition Centre, residential accommodation, and commercial and entertainment facilities.

Currently it is the intention of the redevelopment to combine the newly formed residential, commercial and entertainment facilities with a reduced level of industrial operations within the area. The Stokes and Fort Hill wharves are expected to see a reduction in their industrial use, providing facilities solely for the re-fuelling and loading/unloading of navy and cruise vessels. Due to security issues, the current Navy use of the Iron Ore wharf may become unfeasible upon completion of the development. The Iron Ore wharf is hence expected to be decommissioned and refurbished to accommodate an alternative future use.

Commercial and retail facilities within the area are expected to expand as a part of the development, with Stokes Hill Wharf expected to include several restaurants, bars, cafes etc. Similar facilities are expected nearer the Convention and Exhibition Centre.

Accommodation facilities are expected in the form of serviced apartments and possibly a hotel, complimenting the Convention and Exhibition Centre. At this stage, it is likely that a residential use with be incorporated at the former Stokes Hill power station site. Additionally, preliminary layouts suggest the waterfront area nearest Fort Hill Wharf may also be developed to include residential accommodation.

As a part of the development, the Territory requires the incorporation and early construction of a Convention and Exhibition Centre. The centre, acting as the catalyst for the redevelopment, is expected to cater for both indoor and outdoor events and provide easy pedestrian access to and from Smith Street within Darwin's CBD. A 4000 square meter internal exhibition space, providing approximately 1500 seats, is expected within the proponent's proposals. The exact location of this facility is unknown at this stage, however a central position seems favoured.

To support the waterfront/wharf aspect of the development, several designs for upgrading of the marina are being considered. The inclusion of mechanisms within the structure, minimising the impact of the 8m tidal fluctuation within Darwin Harbour, are being considered.

1.4 Assessment of Potential Impacts

Noise generated as a result of the wharf development may impact upon both surrounding premises, and premises within the development itself.

The noise sensitive premises potentially impacted by noise from the development are:

- External to the development's boundary
 - Government House
 - Residential premises, The Esplanade.
- Proposed as a part of the development with the development's boundary
 - o Serviced apartments proposed
 - o Hotel accommodation proposed

The main aspects of noise generation within the development, supporting a potential impact on the above premises, have been identified in the following sections.

1.4.1 Wharves

It is anticipated, and an aim of the project, that a large percentage of the wharves current commercial activities (servicing of small vessels, cruise liners, restaurants etc) are to continue throughout both the construction phase/s of the wharf development, and upon its completion. Noise from these activities forms a potential impact upon the development's use.

Services for marine vessels conducted throughout the night-time periods (19:00 - 07:00 hours) stands out as the primary consideration for noise impacting upon proposed residential accommodation facilities within the development.

The on-site noise survey conducted in April 2004, showed noise levels from vessels at idle within the wharves not to impact significantly upon proposed residential locations. Motor noise alone, based on the 75dB(A) at 3m measured for commercial fishing vessels, is not expected to necessitate acoustic mitigation measures. The servicing (loading/unloading) of such vessels however, unable to be measured, would be likely to generate higher impact noise levels throughout such events.

1.4.2 Convention and Exhibition Centre

The entertainment complex is proposed to cater for both indoor and outdoor events, with a maximum anticipated internal capacity of approximately 1500 persons (conference use). Noise generated by this facility is expected to comprise of the following:

- Entertainment noise
 - Break out from the internal space
 - External noise from outdoor events
- Mechanical and Electrical Noise
 - Air conditioning plant noise (likely to be roof mounted unit/s)
 - Refrigeration systems
 - o Ventilation systems

Typically it is expected that entertainment events, as opposed to conferences, will be conducted throughout the evening and night-time periods. Any noise generated from such events throughout night-time periods would be required to comply with more stringent night-time noise requirements, relating to the expected reduced background noise levels.

Noise from mechanical and electrical equipment is discussed within section 1.4.4.

1.4.3 Traffic

Following construction, the development will generate an increase in traffic movement in the local area due to an increase in private and commercial road vehicles accessing the development. An increase in road traffic could result in an increase in noise levels on site and the surrounding area. Road traffic predictions will be reviewed once available to determine the expected impact of traffic noise.

Convention and Exhibition Centre

Events held within the Convention and Exhibition Centre should be expected to result in dramatically increased road traffic volumes before and after the event. The extent of this traffic increase is to be determined, with the potential impact established.

New and existing traffic paths will be required to carry traffic associated with vehicles accessing the entertainment complex. Where these traffic paths are located near noise sensitive premises, the associated noise from passing vehicles will generate a noise impact.

Mechanical and electrical equipment (air conditioning units etc.) associated with the facilities will also generate a noise impact. See section 1.4.4 for further discussion.

Residential Accommodation

Road traffic to and from the proposed residential facilities, typically throughout morning and evening periods, will introduce increased traffic volumes both within the development and its surrounding area.

Mechanical and electrical equipment (air conditioning units etc.) associated with the facilities will also generate a noise impact. See section 1.4.4 for further discussion.

1.4.4 Mechanical and Electrical Systems

The redevelopment is likely to incorporate the following fixed equipment and mechanical plant:

- Air-conditioning plant
- Ventilation systems (extract systems; restaurant kitchens, below ground etc.)
- Refrigeration

Due to Darwin's warm climate, many of these items are likely to operate throughout 24-hour periods, creating a potential noise impact on neighbouring noise sensitive premises. Reduced night-time noise criteria again exacerbate the potential impact of such noise sources.

1.5 Mitigation Strategies

SVT have assessed the potential noise impacts discussed within section 1.4, and developed the following recommendations to mitigate the likely noise impacts.

At this stage there is very little information available for giving definitive noise mitigation strategies, however, the following gives an overview of some of the options to be considered.

In reducing the noise impact of noise sources, the following order of noise control strategies should be adopted. Recommendations are presented in order of their ease of application and effectiveness.

- 1. Remove noise source from noise sensitive location.
- 2. Increase the separation distance between the noise source and noise sensitive receiver location.
- 3. Effective orientation of noise sources and receivers
 - a. Avoid creating a layout with noise sources directed towards surrounding receivers.
- 4. Reduce the noise level emitted from the noise source
 - a. Selection of low noise equipment.
 - b. Implementation of noise treatment.
 - i. Acoustic barrier/s (in-situ construction, or may be formed by buildings constructed between source and receiver)
 - ii. Silencer/s (applied to fan intakes and/or discharges etc.)
 - iii. Acoustic louvers (applied to larger air intake or discharge paths etc.)
 - iv. Acoustic enclosure/s (encloses the noisy item or package etc.)
- 5. Reduce the impact of noise at receiver location through the implementation of noise insulation treatments.
 - a. Suitable external façade constructions
 - i. Multiple glazed facades (double glazed, acoustic laminated glass etc)
 - ii. Suitable external wall types (double brick etc.)
 - b. Acoustic ventilation paths
 - c. Minimisation of structure borne sound transmission paths.

The following recommendations made regarding the reduction of potential noise impacts, are based on the above.

1.5.1 Recommended Noise Criteria

The Northern Territory Government currently do not have formal noise regulations in place. It is understood, through discussions with the NT Department of Planning and Infrastructure (Environmental), that attempts have been made to establish noise regulations. At this stage, recommendations from industry professionals regarding guidelines for inclusion within any future regulations, forms the basis of the current NT noise requirements. SVT have discussed these recommendations with NT Government representatives, and include within this document an initial outline of those noise requirements understood to be applicable to the proposed Darwin Wharf redevelopment.

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It should be noted that the following recommended noise criteria do not currently form a part of any formal noise regulation. Should NT noise regulations be formed and hence become enforceable, it should be expected that all new developments, and to an extent existing facilities, shall be required to comply. To avoid future penalties (restrictions to events of the proposed Exhibition Centre etc.), SVT recommend noise limits are established at this stage, and enforced throughout the development's life.

Continuous Noise within Darwin CBD

Throughout discussions with the Northern Territory Planning Department, it was discussed that the Darwin Central Business District (CBD) has seen extensive changes in its use over the past decade. The once commercially dominated use of the city centre has recently seen encouragement from government bodies for the development of residential accommodation, with high density living endorsed. The combination of newly formed residential premises with both existing entertainment and commercial uses (pubs, night clubs, retail shops, restaurants, cafes etc.), has generated difficulties in developing feasibly achievable noise requirements within the CBD.

The NT Planning Department currently recommend continuous noise from new developments (air conditioning, ventilation systems etc.) do not exceed a certain level of noise at residential premises, with the separation distance determining the allowable level of noise at the source. Existing facilities within the CBD however, are required to conform to relaxed conditions generally aimed at avoiding a noise annoyance being created. Where a new residential development is proposed near an existing facility (and its associated noise sources), the onus is largely placed on the new development to incorporate suitable construction methods such that a satisfactory internal noise environment is achieved (see section 1.5.2, table 2).

In developing guidelines for the control of noise within Darwin's CBD, the Northern Territory Planning Department currently recommend a noise level of 60dB(A) at 1 meter from any residential premises (residential apartment, hotel etc.) is not exceeded throughout daytime or night-time hours. SVT have assessed this requirement, and recommend a reduced limit of 45 - 50dB(A) at 1 metre be established as the noise target for the Darwin Wharf redevelopment.

The above reduced noise criteria (45 - 50dBA at 1m) considers the worst case scenario of noise at 1 meter from an open-able bedroom window (typically 10dB reduction), achieving a predicted internal noise level of 35 - 40dB(A), in compliance with corresponding Australia Standards (See section 1.5.2). Where the reduced limit is found to be feasibly unachievable for the redevelopment, it is recommended that suitable compromises are implemented (improved acoustic performance of external fabric for newly formed/proposed noise sensitive uses etc.) to counteract any required increase in allowable external noise levels.

Construction Noise

The Northern Territory allow noise from construction sites between the hours of 07:00 and 19:00 hours Monday to Saturday, to be controlled through the implementation of best practical means. All efforts are required to be made to reduce noise where feasible, to within the allowable levels set within AS2436. Written notice is to be issued, at least 48 hours before the proposed works, to the occupiers of all noise sensitive premises where the maximum allowable noise level of the site is likely to be exceeded. The notice is required to contain information relating to the proposed construction work and the times and dates at which the

work is proposed to be undertaken. Additionally, the name and address of the person to whom a complaint may be made about noise emission from the site must be included.

Where construction activities are required between 19:00 and 07:00 hours (night-time), it is required that a Noise Management Plan (NMP) is established for the works, with a significant reason stated for the required timing of the proposed works. The NMP is to contain the proposed schedule of works and activities, and an explanation all noise control techniques planned to be undertaken.

Entertainment Noise

In the absence of formal noise regulations, the NT Planning Department recommend entertainment noise (amplified music etc.) be controlled such that a noise annoyance is not created. As discussed within section 1.5.1, new residential accommodation has recently been introduced within the Darwin CBD. The incorporation of such premises, often near existing entertainment facilities, has lead to the requirement for new guidance regarding the control of entertainment noise.

Currently the NT Planning Department recommend facilities incorporating amplified music (live music, loud speaker systems etc.) are categorised depending upon the expected level of amplified noise to be generated internally. Those premises where the level of amplified music anywhere within the venue's internal space (greater than 3 meters from any speaker) exceeds 85dB(A), are deemed *entertainment venues* and required to comply with specific noise criteria. Facilities with amplified music generating less than 85dB(A) internally are then not categorised, acoustically, as an *entertainment venue* and required to comply only with that requirement for continuous noise – 60dB(A) at 1 meter from residential premised.

New facilities categorised, for the purpose of noise only, as *entertainment venues* are required to comply with noise limits relating to the existing background noise level. The octave band background noise level is to be measured at the proposed entertainment facility development site prior to its development. The maximum allowable noise level containing amplified music, at 1 metre from the external façade of a proposed *entertainment facility*, is currently recommended not to exceed the measured background noise level at each of the frequencies 63, 125 and 250Hz by more than 10dB.

As seen within figure 1, a typical minimum background noise level of L_{A90} 42dB(A) was measured. In light of additional noise information, SVT would however recommend a typical minimum background noise level of L_{A90} 40dB(A) represent a more typical minimum background level. Combined with octave band background measurements taken on site at approximately 01:00 hours, and the above typical minimum broad-band noise level, maximum allowable noise levels (as per the above entertainment noise limit criteria) at the 63, 125 and 250Hz bands can be established. Table 1 below shows the typical minimum background noise spectrum and resulting entertainment noise limit at the façade of an *entertainment venue*.

	Nois	e Level o	dB(A)	Broadband
	63Hz	125Hz	250Hz	dB(A)
Typical Minimum Background Noise	30	32	36	40
MaximumAllowableNoiseLevel(External) at 1m from Entertainment Venue	40	42	46	50

Table 1 – Maximum	Allowable	Entertainment	Noise Level	(External)
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Assuming internal noise levels of greater than 85dB(A) are to be generated within any proposed entertainment facility, the relationship between its construction and allowable internal noise levels will be based on the typical minimum existing background noise level measured throughout the proposed period of operation.

Based on the above information, and where an Entertainment Venue is generating 85dB(A) at an external façade (internally), the venues façade construction would be required to achieve a minimum noise reduction of 35dB(A). Such a performance is achievable via a high performance double glazing system and/or most structural building materials (brick, concrete etc.). Any increase in the expected internal noise level would then require and equal increase in the acoustic performance of the venues external façade, for the external noise limit to remain achievable. Such a limit then becomes extremely onerous (upon the required acoustic performance of external building fabric) once high internal noise levels are expected.

Where any proposed facility is categorised, for the purpose of noise only, as a *non-entertainment venue*, it is recommended that the impact of low frequency noise on surrounding premises is assessed, further to the NT Planning Department's broad band 60dB(A) recommendation.

Guidelines regarding noise from outdoor entertainment events are currently unavailable. SVT recommend, similar to noise from construction sites, that all occupiers of noise sensitive premises where a noise level of 60dB(A) at 1 meter from the external façade is likely to be exceeded, receive written notice of the likely exceedence at least 48-hours before the proposed event. All practical means should be implemented to reduce the impact of any outdoor entertainment events. A detailed assessment of noise from outdoor events is recommended to be conducted once details are available.

Although no noise regulations stipulate the requirement, it is typically expected that a large entertainment complex such as that proposed with the redevelopment, incorporate a Noise Management Plan (NMP). A NMP is recommended for the Darwin Exhibition and Conference Centre, due to its close proximity to the CBD and surrounding noise sensitive premises (Government House etc.) The management of noise from external events should form an integral part of this document.

1.5.2 Internal Spaces

Further to the guidance generated above regarding noise limits, Australian Standard 2107 (AS2107) provides recommendations for levels of noise intrusion to internal spaces, from an external source or event. Table 2 below includes the recommended internal noise levels. Predicted external noise levels will then enable the required acoustic performance of buildings' external fabric to be established.

Table 2 – Recommended levels of external noise intrusion.

Type of Occupancy / Activity	Recommended Design Sound Level, L _{Aeq} dB(A)		
	Satisfactory	Maximum	
Public Buildings			
Exhibition Areas	40	50	
Restaurants and Cafeterias			
Restaurant	45	50	
Coffee Shops / Café	45	55	
Accommodation Buildings			
Sleeping Areas	25	40	
Living Areas	30	45	
Common Areas (lobby etc.)	45	55	
Commercial Buildings			
Small retail	45	50	

A combination of noise limits and external façade design is recommended to achieve internal noise levels within that range shown within table 2.

1.5.3 Development Layout

As discussed towards the beginning of section 1.5, increasing the separation distance between the source and receiver can help to reduce noise impacts. At this early stage of design, the layout of the redevelopment may be tailored to accommodate reducing any potential noise impacts by adopting this strategy.

Traffic Paths

It is recommended the separation distance between main access roads and premises is maximised where feasible. Furthermore, the volumes of traffic passing these premises should be minimised, reducing the frequency and duration of noise exposure. The inclusion of ancillary roads should be considered to direct only that traffic associated with the residential premises within the noise sensitive area.

Traffic planners should be expected to incorporate the above considerations, and where feasible, avoid main access roads directly passing noise sensitive premises. Furthermore, the distance from the access and egress road/s associated with the Exhibition centre, to the noise sensitive premises, should be maximised to reduce the noise impact of patrons' vehicles.

Mechanical and Electrical Equipment

The location of mechanical and electrical plant equipment, and their associated noise paths (air inlets and discharges etc.), should be selected away from noise sensitive premises. Specifically, such noise sources should be located away from bedrooms any external entertaining areas (balconies etc.).

Where mechanical systems are required to include air inlet or discharge paths near a noise sensitive use (residential, hotel etc), the direction in which such a duct or louver is incorporated should encourage noise emission away from noise sensitive premises.

Residential Accommodation

At this stage, it is anticipated that residential accommodation will be incorporated on the waterfront area around the Fort Hill Wharf, and at the former Stokes Hill power station site.

It is recommended that noise sensitive premises be located away from noise sources or noisy events.

From initial noise survey work completed in April 2004, noise information obtained from moored fishing vessels (motor noise at idle) suggests specific acoustic facades would not be required to achieve reasonable internal noise intrusion. The servicing (unloading/loading) of vessels throughout night-time hours may however generate higher noise levels than that measured throughout the survey. It is recommended such activities do not exist throughout night-time hours (22:00 - 07:00 hours).

Ideally, the layout of noise sensitive premises should consider bedrooms being located away from areas exposed to high noise levels. Where this works against the aesthetic requirements of the premises (required outlooks etc.), and activities cannot be limited to daytime hours, acoustic treatments may be required to achieve recommended internal noise levels stated with table 2, section 1.5.2.

Once the layout and location of noise sensitive premises are known, acoustic recommendations can be made regarding suitable external fabric constructions.

1.5.4 Traffic

Road traffic noise is expected to impact the development and its surrounding premises. Traffic flow and volume predictions will be examined to determine the likely change in noise levels.

The external fabric of buildings within the development are recommended to be design to achieve satisfactory noise reduction, achieving internal noise levels in accordance with table 2 within section 1.5.2.

1.5.5 Mechanical and Electrical Services

Noise from mechanical and electrical service equipment (see section 1.4.4) must be controlled such that the recommended noise limits are not exceeded at surrounding noise sensitive premises (see section 1.5.1). Additionally, more localised noise limits commonly apply to mechanical and electrical equipment near public spaces, pedestrian walk ways etc. Generally a noise limit of 55 - 60dB(A) at 1 metre from a public space should apply.

Once development layout details are available, item specific noise limits should be established to include the cumulative effect of multiple noise sources. Section 1.5.6 outlines a method for establishing guidance towards acceptable levels of noise from continuously operating equipment. Silencers and acoustic louvers should be specified to achieve item specific noise limits established, with low noise equipment selected where possible.

1.5.6 Wharf Activities

Although current noise information suggest wharf activities will not negatively influence residential premise within the development, any noise impact associated with the servicing of

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navy and cruise liner vessels (re-fuelling, loading/unloading etc.), could be minimised through effective planning and layout design of these premises. It is recommended all wharf servicing requirements are limited to daytime hours. Recommended night-time internal noise levels for noise sensitive premises along the waterfront would hence become more easily achievable, removing the possible requirement for acoustic facades.

1.5.7 Item Specific Noise Limits

As discussed within section 1.5.5, noise from such continuously operating equipment as identified with section 1.4 (with any additional noise sources highlighted once details are available) should have item specific noise limits established. Such noise limitations are recommended such that maximum allowable noise levels at surrounding noise sensitive premises (see section 1.5.1) are not exceeded.

To generate general guidance for the maximum allowable noise levels at individual continuously operating noise sources, the formula 1 below can be implemented:

Formula 1 – Guidance for allowable noise from mechanical and electrical items

$L_{p \text{ SOURCE}} = L_{p \text{ MAXIMUM ALLOWABLE}} + 20 \text{ x Log (D)} - 10 \text{ x Log (N)}$

Where:

_	L _{p SOURCE}	=	Maximum sound pressure level at 1 meter from the noise source (fan, motor etc) to achieve compliance.
	L_p maximum allowable	=	Maximum allowable noise level from guidance. This level must correspond to the latest possible operating time of the source.
	D	=	Distance in meters, between the noise source and noise sensitive premises (house, apartment, hotel etc) boundary.
	Ν	=	The number of permanent noise sources likely to affect noise levels at the receiver location.

In should be noted that, depending on the separation distance, the size and radiating characteristics of the noise source will affect the maximum allowable noise level.