Acoustic Report

Northern Residential Precinct

Tallawarra Lands Part 3A

Project 211 106

August 2011

File : *211 106 R01 v1-1 Acoustic report*

Prepared For:

TRUenergy
Level 33, 385 Bourke Street
MELBOURNE, VIC, 3000

email: anthony.savenkov@TRUenergy.com.au

Prepared By
Matthew Ottley
Peter R Knowland & Associates Pty Ltd
t/a PKA Acoustic Consulting
Suite 12, 401 Pacific Highway
ARTARMON, NSW, 2064
ABN 73 001 594 583, ACN 001 594 583
Telephone: (02) 9460 6824, Facsimile: (02) 9460 6823

Document Information

File: *211 106 R01 v1-1 Acoustic report*

Author: Matthew Ottley

Checked: Simon Connolly

Revision: 1.1

Distribution:

Date	Copies	Version	To:	By:
2/8/11	1	1.0	TRUenergy	Anthony.savenkov@TRUenergy.com.au
2/8/11	1	1.1	TRUenergy	Anthony.savenkov@TRUenergy.com.au

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1 INTRODUCTION

TRUenergy own Tallawarra, a large infill land site located on the East Coast, South of Wollongong. The land was originally part of a coal fired power station, long ceased operation and since demolished.

A new gas fired power station has been constructed and commissioned using superefficient Combined Cycle Gas Turbine (CCGT) technology. Additionally, a development approval has been obtained for Tallawarra power station Stage B, another TRUenergy power station to adjoin stage A.

The current technology offered by the gas fired station together with substantial noise control measures being incorporated in the design and construction mean that much of the land at Tallawarra is now surplus to the requirements of the power station.

Known as “Tallawarra Lands”, this surplus land has recently been rezoned. The proposed land use outcomes are a mix of environmental and recreational, business/industrial/commercial, and residential zones.

TRUenergy have recently lodged a concept plan development application for development of the land for multiuse purposes including residential, business / commercial and light industrial.

As part of the power station redevelopment for Stage A and B TRUenergy have commissioned SKM Consulting Engineers to examine noise impacts generated by Stage A and B CCGT, together with existing noise from the Southern Freeway and the Illawarra Rail Line on the Tallawarra Lands subject to rezoning. The results of the SKM assessment is detailed in SKM report *Tallawarra Lands Part 3A Concept Plan Application, Final v5, 19 January 2011, Project Number EN02773.*

This report provides noise contour information across the site as a result of existing and expected noise from the power stations, south Western Free way and the Illawarra Rail Line.

PKA Report requirements

PKA have been commissioned by TRUenergy to examine the SKM report and the documented expected noise levels. PKA are required to nominate typical building measures for the Northern Residential Precinct based on the newly prepared subdivision layout in order to control internal noise to within satisfactory limits.

The results are based on the preliminary lot layout for the Northern (Residential) Precinct shown in Northrop drawing number SK102 Revision 2 (Job Number 10359).

This report provides the results of our investigation. Recommendations are made for the typical acoustic requirements for each of the proposed building facades and envelopes.

The primary focus of this report is to address noise from the power station. Noise from the Southern Freeway, Illawarra Rail Line and Illawarra Regional Airport are discussed but no specific noise control treatments are required to address noise from these sources at the Northern Residential Precinct.

2 SUMMARY

It is proposed to redevelop the lands identified as the Northern Residential Precinct, which lie within the Tallawarra Lands, to the north of the Tallawarra Power station.

SKM have carried out noise modelling over the proposed redevelopment area. The modelling includes noise impacts from the existing and proposed power stations, the Southern Freeway and the Illawarra Railway. The only significant acoustic impact on the Northern Residential Precinct is from the existing and proposed power stations.

PKA have considered the modelled noise levels and their effect on a “standard” two level dwelling.

Noise levels across the site are not expected to be high in absolute terms; however we expect that a number of dwelling locations will require some form of acoustic upgrading. The building upgrades are expected to be relatively minor.

It should be noted that windows would need to be closed in order to meet the proposed internal goals acoustic at a number of dwelling locations.

This has implications for ventilation. Mechanical ventilation and air conditioning have been traditionally been incorporated however BASIX ratings are likely to discourage these options.

We note however that the noise contour information as based on undeveloped land and do not take into account the possible screening effects due the future dwelling and lot layouts. It is therefore possible that lots that are not in close proximity to the power station may be subject to lower noise as a result of closer lots.

3 ASSESSMENT CRITERIA

The noise emissions from the power station, freeway and railway line are very different in character. As such they cannot be assessed using the same noise criteria.

3.1 Power Station

We propose to include the recommendations of *Australian/New Zealand Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors.* The following is an extract from the standard, applicable to residential dwellings:

TABLE 1
RECOMMENDED DESIGN SOUND LEVELS FOR DIFFERENT AREAS OF OCCUPANCY IN BUILDINGS

Type of occupancy/activity	Recommended design sound level, LAeq, dB(A)		Recommended reverberation time (T), s
7 RESIDENTIAL BUILDINGS (see Note 7 and Clause 5.2)			
Houses in areas with negligible transportation-			
Sleeping areas	25	30	-
Houses and apartments near minor roads-			
Living areas	30	40	-
Sleeping areas	30	35	-
Work areas	35	40	-
Apartment common areas (e.g foyer, lift lobby)	45	55	See Note 3
Houses and apartments near major roads-			
Living areas	35	45	
Sleeping areas	30	40	
Work areas	35	45	
Apartment common areas (e.g. foyer, lift lobby)	45	55	See Note 3

We consider that the classification for houses and apartments near minor roads is appropriate. As such this provides the following noise criteria relevant to this development

Area	AS2107 recommendation	PKA Proposed Design Criteria (unadjusted)	Adjusted for tonality
Living areas	30-40	35	30
Sleeping areas	30-35	30	25
Work areas	35-40	35	30

The tonality correction is necessary to allow for the potential non-broadband character of the noise from the power station. We note however that the Sound Plan noise level predictions prepared by SKM already include a penalty for potential tonality. As such we will apply the SKM predictions to the unadjusted internal noise criteria.

The appropriate assessment criterion for potential noise disturbance to sleep is currently under review by the Office of Environment and Heritage (OEH, formerly DECCW/EPA).

As a guideline the DECCW have in the past (*Environmental Criteria for Road Traffic Noise* (1999) and *Environmental Noise Control Manual* (1985)) sought to protect sleep arousal by ensuring that the $L_{1(60sec)}$ noise level of any specific source does not exceed the background L_{90} level by more than 15dB(A) outside a resident's bedroom window between 10pm and 7am.

The most recent noise policy issued by the OEH is the NSW Road Noise Policy (2011) which concludes that "maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep".

The background +15dB(A) criteria would lead to a site specific criteria of 36 + 15 = 51dB(A) (external) for the Northern Residential Precinct. Assuming typical dwelling construction this would lead to an internal noise level in the order of 41dB(A) with windows open.

In the absence of any specific directions otherwise we have applied an Lmax criteria (for sleeping areas only) of 51dB(A) external and 41dB(A) internal for the Northern Residential Precinct.

3.2 Other Noise Sources

The SKM report sets out noise criteria for other noise sources impacting the Tallawarra Lands including:

- Road traffic noise from the southern freeway
- Rail noise from the Illawarra Rail Line
- Aircraft noise from Illawarra Regional Airport

The SKM report indicates noise from the above sources are all below the relevant criteria that the Northern Residential Precinct. Our inspection of the noise data within the SKM report confirms that noise from the above sources do not significantly impact the Northern Residential Precinct.

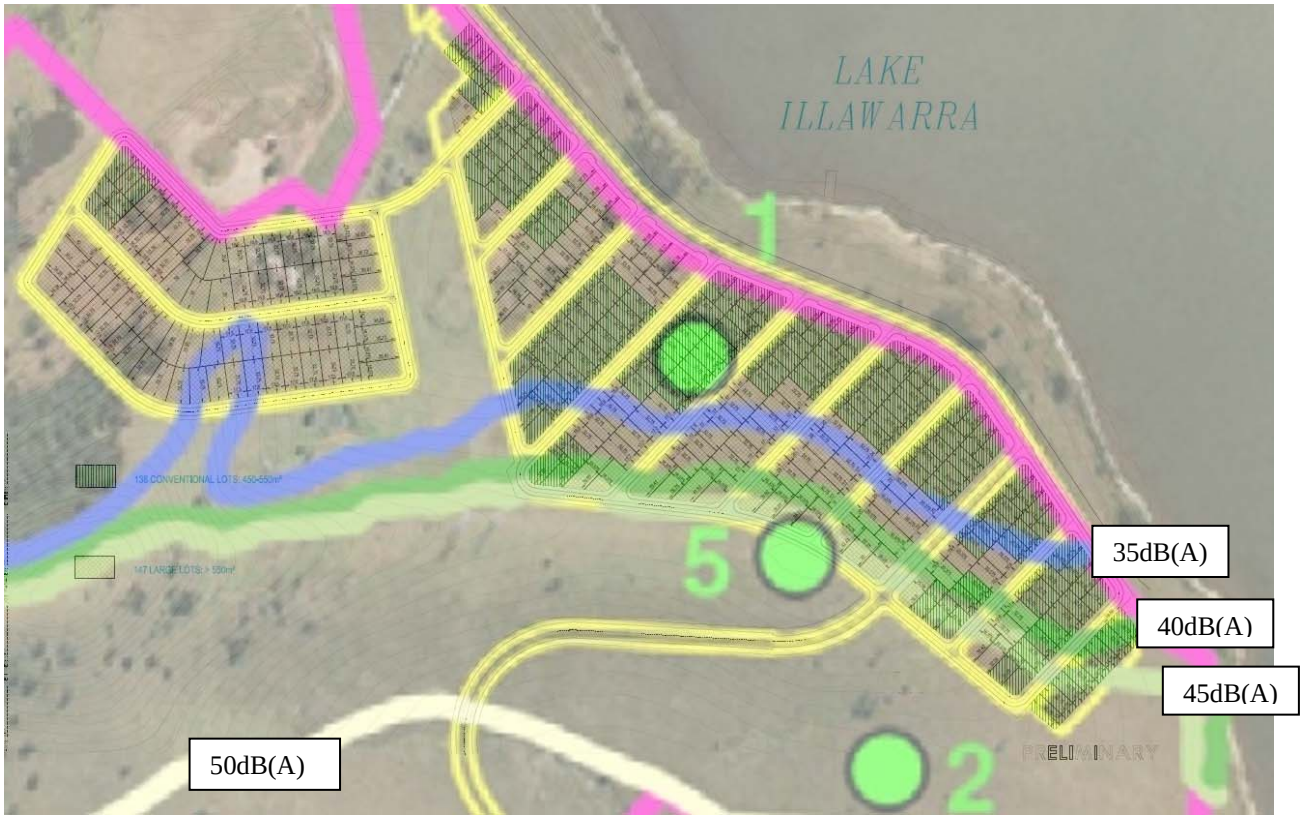
4 NOISE SOURCE DATA

Noise level data for the completed stage A and the projected stage B power stations have been taken from noise contour data prepared by SKM. We have based the assessment on the combined operations of the Stage A and B as prepared by SKM in Figures 4-1 (Leq) and 4.2 (Lmax).

The applicable noise contours from the report have been superimposed on the current subdivision layout and are reproduced below.

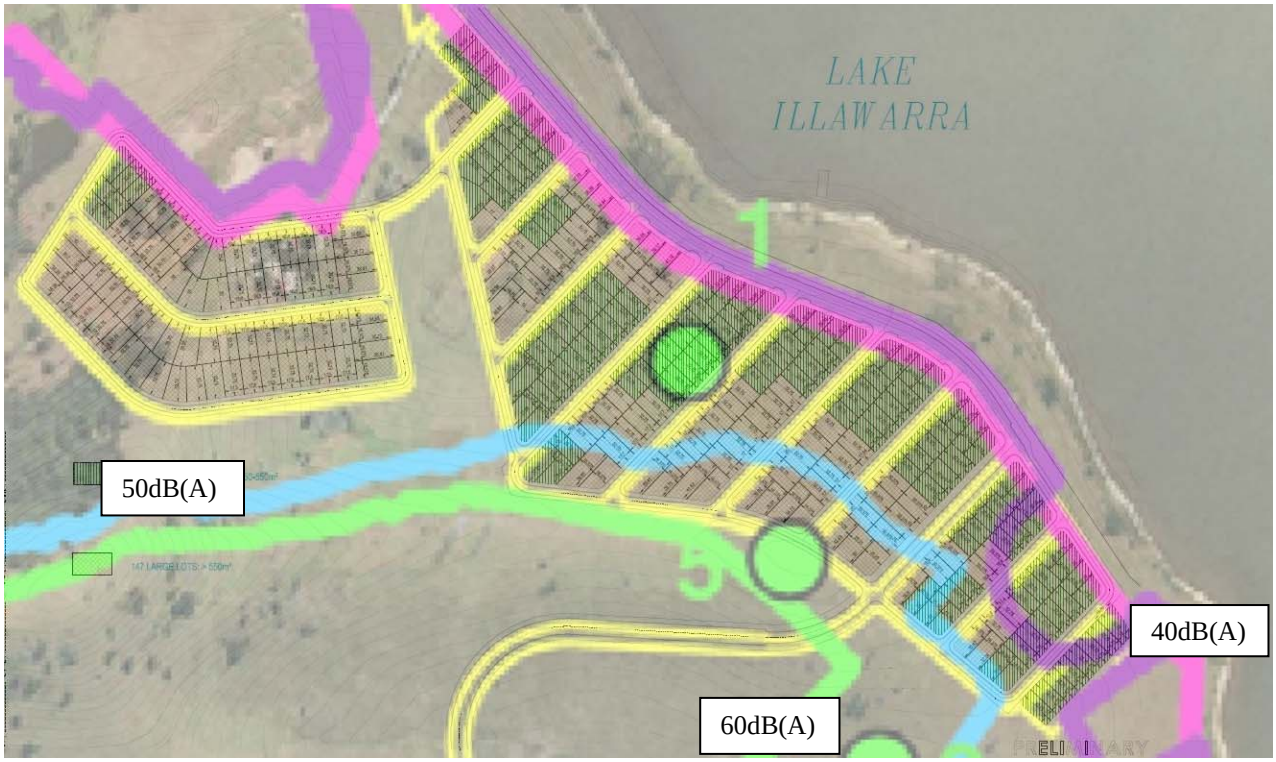
SKM have advised that the Leq noise contour includes a +5 dB(A) penalty for the expected low frequency components.

Fig 1: Tallawarra A & B Power Station L_{Aeq} Noise Impacts dB(A)



35dB(A) shown in blue
40dB(A) shown in dark green
45dB(A) shown in light green
50dB(A) shown in cream
Pink line shows project boundary

Fig 2: Tallawarra A & B Power Station L_{Amax} Noise Impacts dB(A)



40dB(A) shown in purple
50dB(A) shown in blue
60dB(A) shown in green
Pink line shows project boundary

5 SITE ANALYSIS

We have based our assessment on the Northern Residential Precinct Preliminary Lot Layout prepared by Northrop (drawings SK102 Rev 2). The plan shows the lots within the proposed residential area comprising conventional and large lots. We have reproduced the lot layout overleaf.

We have marked three different noise control zones within the precinct. We have tabulated a rationalised noise level for each zone. The noise level noted is the highest expected noise level based on the Leq and Lmax noise contours predicted by SKM.

It will be appropriate to verify these levels by carrying out more detailed modelling and / or surveys closer to final design or DA.

Fig 3: Noise Control Zones

The table below sets out the estimated noise levels in each zone of the precinct, based on the SMK contours (SKM figures 4-1 and 4-2 / PKA figures 1 & 2). These levels exclude façade reflection.

Zone	Power Station L_{Aeq}	Power Station L_{Amax}
A	47	60
B	45	60
C	<40	<50

Lots in Zone C have noise levels below the relevant noise criterion and will not require any specific acoustic treatment.

6 TYPICAL DWELLING TYPE

Residential dwelling construction can take many different forms and this will impact on any necessary acoustic treatment. We have elected to consider a conventional 2 level dwelling layout, obtained from publically available information from the Clarendon Homes Website.

http://www.clarendon.com.au/Homes/Detail.aspx?IdDataSource=1&state=nsw#

We have selected the Acacia design as it includes a number of standard construction techniques:

- Large full height glazing
- Brick veneer walls
- Tile roof
- Partial light weight upper wall cladding

The dwelling selection is academic and any standard design would be suitable. The purpose is to illustrate the varying acoustic construction requirements across the different areas of the proposed Tallawarra Lands development.

It would be necessary to incorporate the eventual dwelling design proposed for the applicable lots as some acoustic treatment is likely to be dependent on the final dwelling design.

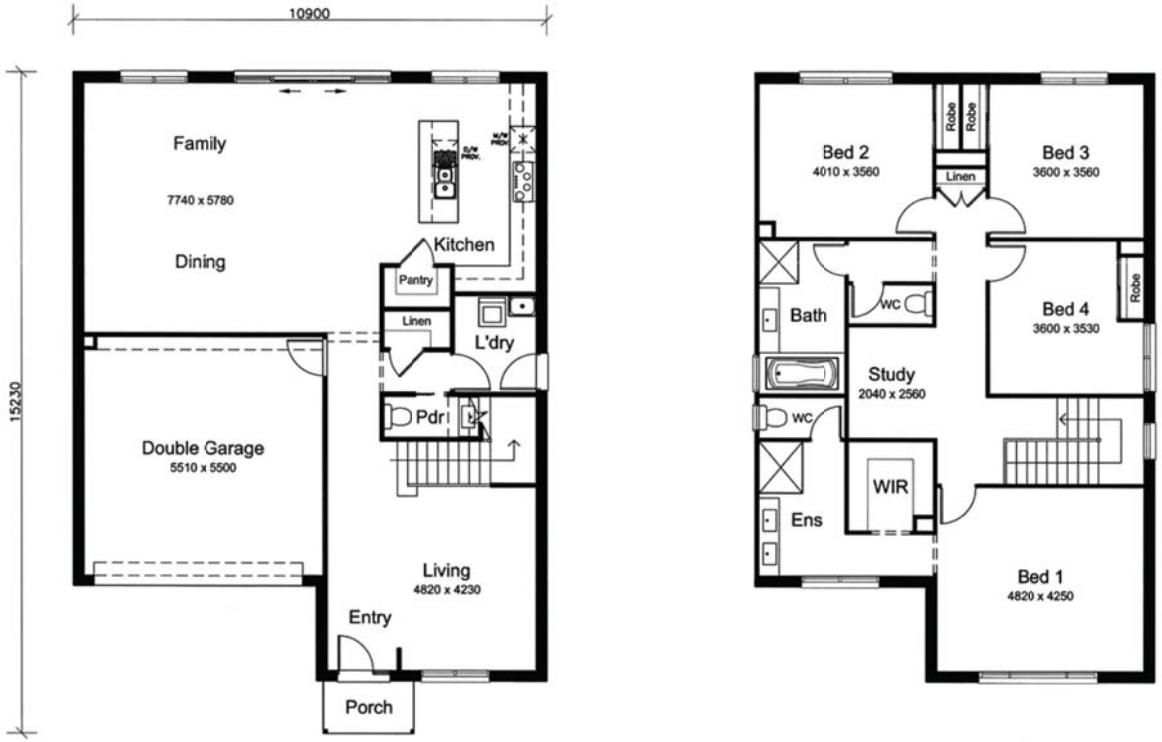
In the meantime we have reproduced the floor plan obtained from Clarendon's web site.

Acacia

28.45 squares
264.31 square metres

Ground Floor	107.75 sqm
First Floor	121.13 sqm
Garage	32.91 sqm
Porch	2.52 sqm

Size based on Traditional Facade
All room dimensions are width x depth
Effective from March 2008
Scale 1:100



x _____

x _____

Date ____/____/____

Clarendon Residential Group

Legend — brick veneer — light weight cladding

Note: Houses that do not have eaves include light weight cladding above the windows and doors to the side and rear elevations and above garage doors.

7 DWELLING CONSTRUCTION

The assessment will be based around the Clarendon Homes Acacia Design without any specific acoustic treatment. Most new dwellings will however include some insulation as part of the need to meet the BASIX provisions.

Typically walls will include at least R1.5 insulation and ceilings R2.5 insulation. More may be required depending on the relevant BASIX requirements and this would need to be determined by others.

The following outlines the base construction assumptions for the standardised dwelling.

7.1 Brick Veneer External Walls

The following construction has been assumed for the bulk of the external walls:

- 110 mm external brickwork
- Timber / steel internal framing as necessary
- R1.5 wall cavity insulation
- 10mm internal plasterboard lining
- No ventilation openings in external brick wall leaf
- All ground level walls constructed from a concrete floor slab

For the purposes of this assessment we have allowed a Weighted Sound Reduction Index (Rw) 50 for the construction of this element.

We have adopted this construction as a “standard” brick veneer wall cladding. Acoustically sealed eaves connections are shown in detail 208-040/1 within this report.

7.2 Lightweight Wall Claddings

In many cases it is likely that some upper walls would be constructed around lightweight claddings. This will not have the same sound insulating properties as a brick veneer wall and therefore would not be the equivalent of the standard system proposed within the rail noise guidelines. A typical lightweight wall system would comprise the following:

- 9.5mm Weathertex external cladding (shiplap)
- Rhino wrap
- 70mm studs and R2.0 Bulk insulation
- 10mm plasterboard internally

We have adopted this construction as a “standard” lightweight wall cladding.

For the purposes of this assessment we have allowed a Weighted Sound Reduction Index (Rw) 35 for the construction of this element.

Typical acoustically sealed connections between the light weight wall and the eaves / brick veneer wall is shown in details 208-040/1 and 2 within this report.

7.3 Glazing

The acoustic performance of the glazing will largely determine the internal noise levels within the dwelling. The acoustic properties of the glazing are typically much less than those of the external walls and the roof / ceiling.

The acoustic properties of the glazing will depend on the thickness and type of the glass and the quality and air tightness of the framing system.

The following assumptions have been made for the glazing:

Windows 3-5mm thickness glass, system)	Rw 20 (any standard glazing
Glazing sliding or other full height doors, 5-6mm thickness glass system)	Rw 24 (any standard glazing

Noise also reduces though a partially open window, typically defined as 20 % of the floor area. The standard allowance is a 10 dB(A) reduction from outside to inside, to the middle of the room. This is an important aspect in determining whether or not it is necessary to close windows to meet the required internal noise goals.

This report nominates various Rw rating for windows. Rw refers to the weighted sound reduction index of a building element, as measured in an acoustic laboratory. It provides a broad indication of the degree of sound reduction offered by the element. The higher the Rw rating the better the sound insulation or reduction is offered by the element.

Note that the Rw rating is required for the complete glazing and frame assembly. The minimum glazing thicknesses will not necessarily meet the required Rw rating without an appropriate frame system. It will be therefore necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting that required in the above table. It is necessary to submit such laboratory certification (eg NAL or CSIRO) for the proposed glazing systems (ie windows and framing systems) for approval prior to ordering or commitment.

The entire frame to the glazing must be sealed into the structural opening using acoustic mastics and backer rods. Normal weather proofing details do not necessarily provide the full acoustic insulation potential of the window system. The manufacturer's installation instructions for the correct acoustic sealing of the frame must be followed.

It will be necessary for the builder to prepare all necessary acoustic details showing the connection of the glazing and framing to the surrounding building structure slabs (and roof on upper levels). These details must be submitted for approval prior to construction.

It is possible that structural demands for wind loading or fire rating or the like may require more substantial glass and framing assemblies than nominated above. Where this is the case the acoustic requirements must clearly be superseded by the structural or fire rating demands.

The glazing thicknesses provided within this acoustic specification are indicative only and are provided only as a guide. The window assemblies (glass and frame) must be selected on the basis of laboratory tests only.

Many glazing companies have sliding and double hung door and window systems that will provide a certain Rw rating; however there can be large variations between manufacturers on what would appear to be similar glazing systems. For sliding window and door systems requiring greater than Rw 25 some recommended manufacturers and/or suppliers are:

- Micos Aluminium (Geoff Hope/Con Micon, 9661 5100), http://www.micos.com.au/
- Thermosound (9369 3018), http://www.thermosound.com.au
- Christoffel (Karl Christoffel, 9627 4811), http://www.christoffel.com.au
- Sassall Glass & Joinery Pty Ltd, (02 4229 4255)
- Aska Aluminium (Jim Jammao, 9642 8588), http://www.aska.com.au
- Bradnam Windows & Doors (8808 8100), http://www.bradnams.com.au
- Sound Barrier Systems (Tony Angel, 9540 4333), http://www.soundbarrier.com.au

It should be noted that the systems described above are not the only options for achieving the desired Rw ratings. For further alternatives, contact suppliers/manufacturers and any others that can supply documentary evidence on the acoustic performance of their systems as installed.

7.4 Roof / Ceilings

The following construction has been assumed for the roof / ceiling construction:

- Concrete / Terracotta Pitched Tile Roof
- Heavy duty sarking fastened below battens
- R2.5 to 3.0 insulation between joists
- Plasterboard ceilings 10mm thickness

- Ceiling penetrations for down lights and air conditioning excluded from this assessment.
- Skylights and roof ventilators such as whirly birds / gable louvres are excluded from this assessment.
- Eaves sealed to walls as necessary

We have adopted this construction as a “standard” roof / ceiling construction.

The recommended construction types would apply only to habitable rooms below a roof cavity. These include bedrooms, lounges, dining, home theatres, studies and open kitchens.

7.5 Finishes

Room furnishings and finishes will have a significant impact on noise levels within each space. A reflective, unfurnished room with hard finishes will result in a significantly higher internal noise compared with a well furnished room. For the purposes of this review the following assumptions are made:

- All rooms furnished (including beds, lounges cupboard etc) ready for occupation

- Bedrooms fully carpeted with underlay

- All other rooms tiled or timber hard finish as required.

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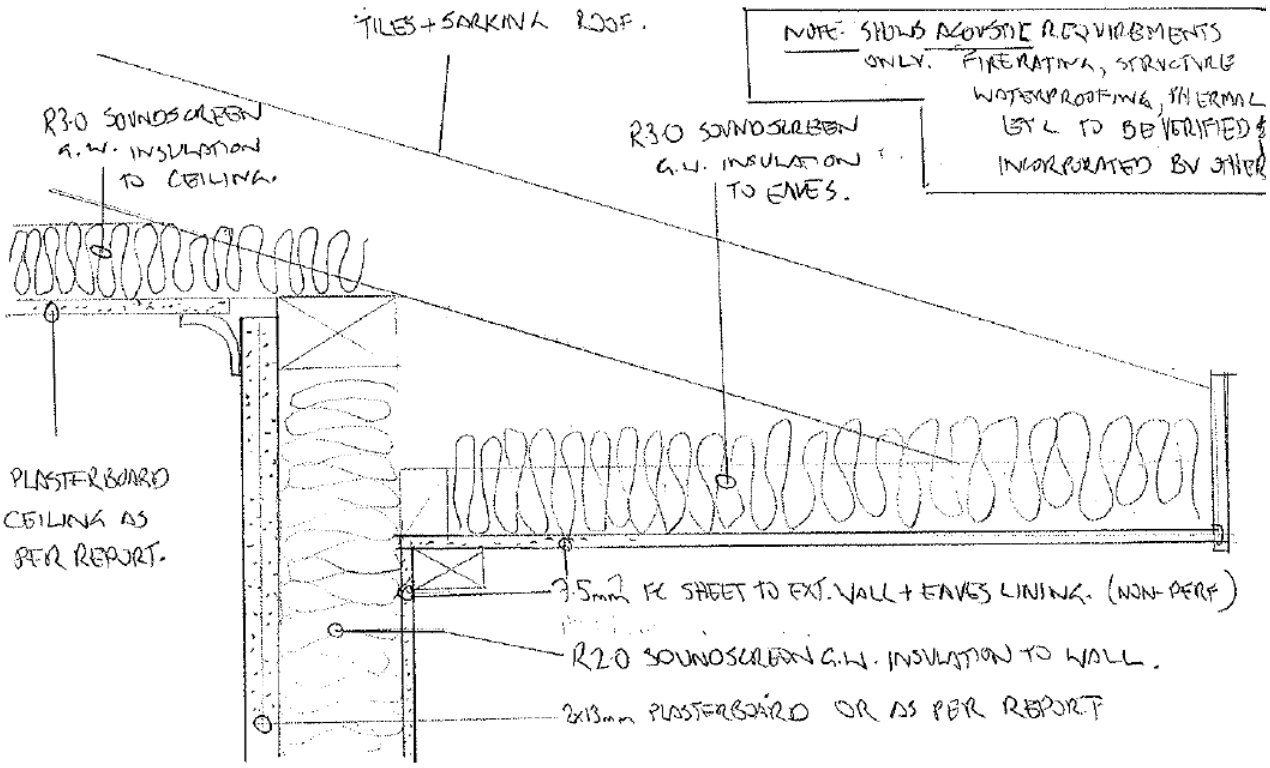
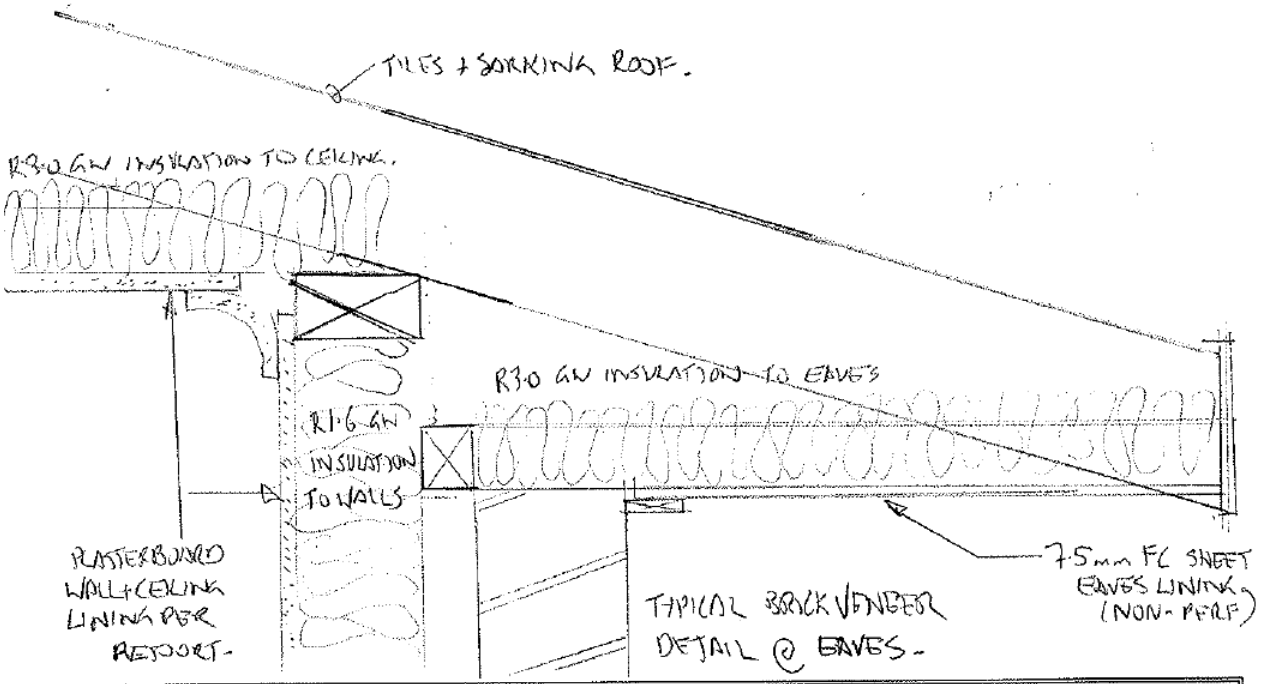


TYPICAL CLAD DETAIL @ EAVES



TYPICAL BRICK VENEER DETAIL @ EAVES.

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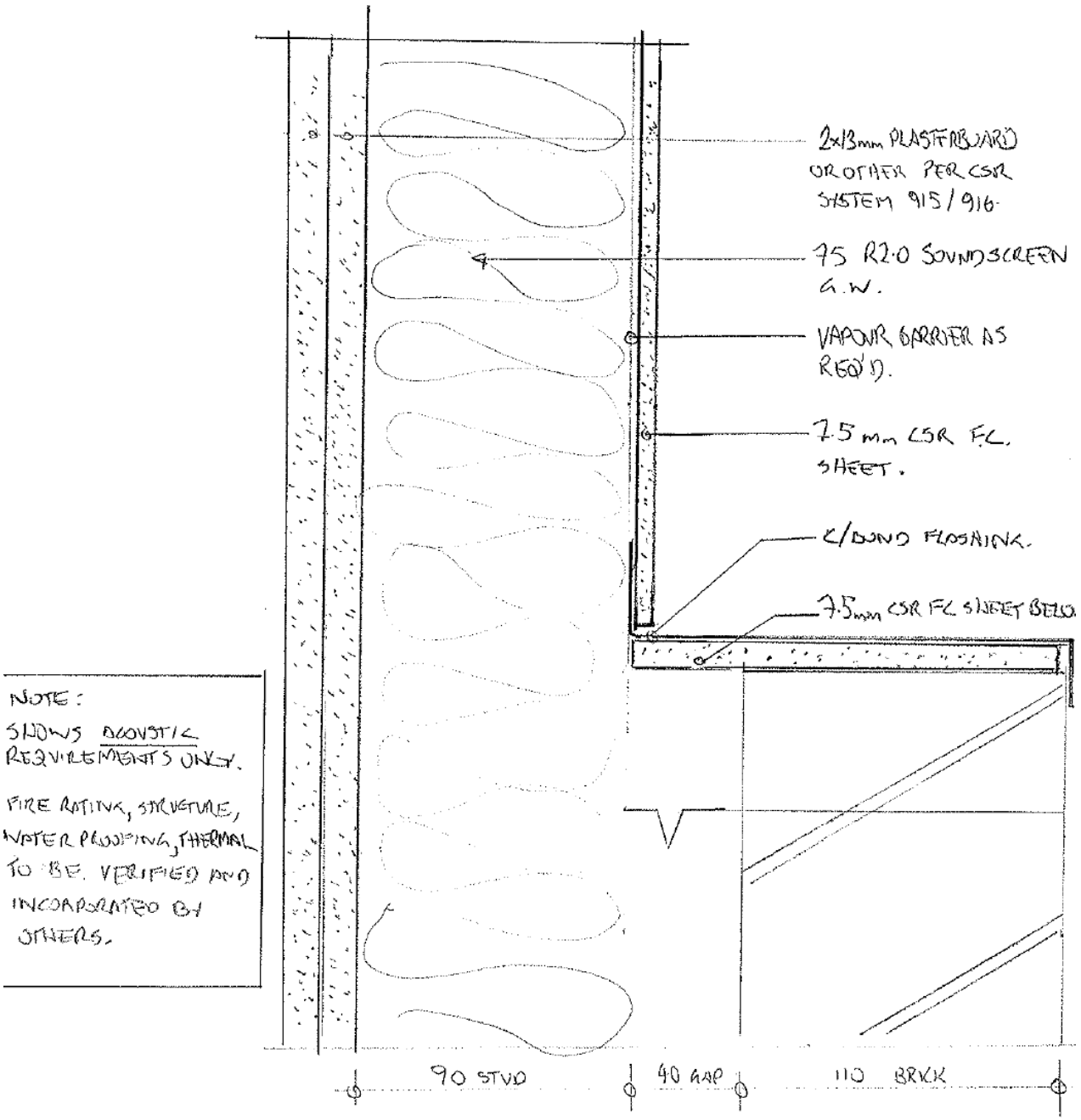
	Drawn By: BT
Drawing Title: TYPICAL ACOUSTIC DETAIL FOR WALL/ROOF AT EAVES.	Drawing No: 2098-040/1
	Date: 6-7-2009

PKA ACOUSTIC CONSULTING
Suite 16, 401 Pacific Highway, Artarmon NSW 2064 Tel: (612) 9460 6824 Fax: (612) 9460 6823
Email: pka@fl.net.au ABN. 73 001 594 583 ACN. 001 594 583
Member Firm of the Australian Association of Acoustical Consultants



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	Drawn By: ST
Drawing Title: TYPICAL ACOUSTIC DETAIL FOR LIGHTWEIGHT CLADDING/ BRICK VENEER CONNECTION	Drawing No: 208-040 / 2
	Date: 6-7-2008

PKA ACOUSTIC CONSULTING
Suite 16, 401 Pacific Highway, Artarmon NSW 2064 Tel: (612) 9460 6824 Fax: (612) 9460 6823
Email: pka@fl.net.au ABN. 73 001 594 583 ACN. 001 594 583
Member Firm of the Australian Association of Acoustical Consultants

8 RECOMMENDATIONS

It should be noted that providing acoustic control via the building facades will mean that relevant windows must be closed in order to achieve the required acoustic insulation. This may have implications for ventilation. It may be necessary to provide ventilation from other, non affected facades or via mechanical fresh air systems.

Where mechanical systems are provided it will be necessary to coordinate the installation to ensure that the insulation offered by the building fabric is not compromised. As an example, penetrations through acoustic rated ceilings must be suitably detailed to ensure the acoustic integrity of the ceiling is maintained.

We have calculated the façade noise levels for each zone, based on the levels set out in the site analysis. These façade levels have been used to calculate corresponding internal noise levels with windows closed or open and to determine the acoustic requirements for the building construction.

In some instances we have assumed certain window orientations with regard to the respective noise source. The window orientation will play a major role in determined the glazing requirement. As such it would be desirable to confirm these issues as the design progresses.

The window requirements are based on a nominal Rw rating. It should be noted that the proposed construction is generalised. It would be desirable to review these requirements for the specific house construction proposed for each site. In particular:

- We have assumed brick veneer wall construction throughout. Light weight wall elements (e.g. upper levels above windows, gables etc will require special detailing.

- It will be necessary to provide special construction details for wall/roof/ceiling interfaces, particularly around the eaves. This is to ensure sound reduction potential of each nominated system is achieved.

It may be desirable to rationalise and coordinate the acoustic treatment depending on specific builder preferences. In some instances the acoustic specification of one element (e.g. window) can be relaxed where the specification are increase for another (e.g. ceiling), depending on relative cost differences.

The following acoustic treatment schedules have been calculated and tabulated:

Zone	Noise Level		Brick Veneer Wall Type	Light weight Wall type	Roof / Ceiling type	Habitable Room Glazing type	Bedroom Glazing Type	Noise criteria met with open windows?
	Power Station L_{Aeq}	Power Station L_{Amax}						
A	47	60	Standard	Standard	Standard	Rw 22	Rw 27	No
B	45	60	Standard	Standard	Standard	Standard	Rw 25	Bedroom – No Other Habitable – Yes
C	<40	<50	Standard	Standard	Standard	Standard	Standard	Yes