planning consultants

Statement of Environmental Effects

Proposed Mixed Use Development

1-13 Marshall Avenue, St Leonards

Prepared for: Loftex Pty Ltd
December 2015

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Printed:	8 December 2015
File Name:	P:\PROJECTS\7920C 1-13 Marshall Ave, St Leonards\3 Reports\7920C.SEE.docx
Project Manager:	D. Kettle
Client:	Loftex Pty Ltd
Project Number:	7920C

Document Control

Version	Prepared By	Reviewed By	Issued To	Date
Draft	David Kettle	Ellen Robertshaw	Client	2 December 2015
Final	David Kettle	Ellen Robertshaw	Client	8 December 2015

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Abbreviations

AADT	annual average daily vehicle trips
ADG	Apartment Design Guide
AHD	Australian Height Datum
AS	Australian Standard
BCA	Building Code of Australia
CC	construction certificate
CIV	capital investment value
Council	Lane Cove Council
DA	development application
DCP	development control plan
DFP	DFP Planning Pty Limited
DoPE	NSW Department of Planning and Environment
DoPI	former NSW Department of Planning and Infrastructure
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPI	environmental planning instrument
FSR	floor space ratio
GFA	gross floor area
JRPP	Joint Regional Planning Panel
LEP	local environmental plan
LGA	local government area
RL	reduced level
RMS	NSW Roads and Maritime Services
SEE	Statement of Environmental Effects
SEPP	state environmental planning policy
VPA	voluntary planning agreement

1 Introduction

1.1 Commission

DFP Planning Pty Limited has been commissioned by Loftex Pty Ltd (Loftex) to prepare a Statement of Environmental Effects (SEE) for a proposed Mixed Use Development at 1-13 Marshall Avenue, St Leonards (the Site).

This report is to accompany a development application (DA) to Lane Cove Council (Council).

1.2 Purpose of this Statement

The purpose of this report is to provide the consent authority and relevant NSW State Government Agencies with all relevant information necessary to assess the subject development proposal and to determine the DA in accordance with Section 80 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The proposed development is Local Development pursuant to Part 4 of the EP&A Act. The proposal has a capital investment value of greater than $20 million, and under Schedule 4A of the EP&A Act, the Joint Regional Planning Panel will be the consent authority. A Quantity Surveyor's Report has been submitted under separate cover.

The DA is made pursuant to Division 4B, Part 3 of the EP&A Act which applies to the lodgement of a DA seeking consent for a development that may only be carried out if an environmental planning instrument applying to the land on which the development is proposed to be carried out is appropriately amended. In particular, Section 72J of the EP&A Act states that:

> *"Nothing in this Act prevents:*
>
> *(a) the making of a development application to a consent authority for consent to carry out development that may only be carried out if an environmental planning instrument applying to the land on which the development is proposed to be carried out is appropriately amended, or*
>
> *(b) the consideration by a consent authority of such a development application,*
>
> *subject to this Division."*

In this case, the proposed development the subject of the DA will be able to be carried out once an amendment to the Lane Cove Local Environmental Plan (LEP) 2009 is made to increase the building height over part of the Site from 65m to 94m.

On Monday 7 December 2015 Council resolved to adopt the Planning Proposal for the amendment to Lane Cove LEP and forward the Planning Proposal to the NSW Department of Planning and Environment for finalisation. The Council also resolved to enter in to the Planning Agreement accompanying the Planning Proposal.

1.3 Project Team

The preparation of the DA has been a collaborative effort by a team of consultants as specified in **Table 1**.

Table 1 The Project Team

Town Planning	DFP Planning Pty Limited
Architectural & Architectural Design Report	Nettletontribe Architects
Traffic and Parking	Traffix
Geotechnical Investigation	JK Geotechnics
Geotechnical Assessment (railway)	Parsons Brinckerhoff and Pile Design Solutions
Contamination	Environmental Investigation Services (EIS)

1 Introduction

Table 1 The Project Team	
Stormwater	Wood and Grieve Engineers
Landscape Architecture	Site Image
Acoustics (Construction Noise and Vibration)	Renzo Tonin & Associates
Acoustics (Residential Amenity)	Renzo Tonin & Associates
Arborist	Arboreport
Solar Light Reflectivity	Windtech
Wind Report	Cermak Peterka Petersen (CPP)
BASIX	BASIX Certificate Centre
Accessibility	McKenzie Group
BCA Assessment	McKenzie Group
Surveyor	Denny Linker & Co.
Waste Management	Elephants Foot Recycling Solutions
Electrolysis	Corrosion Control Engineering
Surveyor	Denny Linker & Co.
Structural Drawings	BG + E

2 Background

2.1 Relevant Planning History

For the purposes of the background, the planning history of the Site needs to be put in context. The Site originally comprised 1-25 Marshall Avenue, St Leonards being a street block. As set out below, part of the original site is now under construction. The remaining part of the original site (the subject of this DA) is known as 1-13 Marshall Avenue.

The site has a lengthy history as set out below.

Date	Event
Feb 2010	The then Department of Planning and Infrastructure (DoPI) gazettes Lane Cove LEP 2009 which zones 1-25 Marshall Avenue (the original site) B4 – Mixed Use with a maximum FSR of 5.1:1 and a maximum building height of 36m. The original site had a site area of 6,300m^2 and with a FSR of 5.1:1 = approximately 31,500m^2 of Gross Floor Area (GFA) or approximately 350 apartments could be developed.
Mar 2010	Loftex commences acquisition of the site over a 12 month period.
Oct 2011	After several meetings with Council planning staff and community consultation meetings, Loftex lodges a Planning Proposal to redistribute the FSR across the site. The Planning Proposal reduced the building height from 36m to 25m for most of the original site, and proposed an increased building height to 78m at the eastern end of the site in order to improve planning outcomes, specifically to reduce building bulk to Marshall Avenue and overshadowing on the southern side of Marshall Avenue. No additional FSR was sought as part of the Planning Proposal.
Apr 2012	The DoPI issues a Gateway Determination and the Planning Proposal proceeds to public exhibition and the plan making process.
Feb 2013	In order to keep the project moving forward, Loftex lodges a DA for a 25m high building at the western end of the original site, despite the building height still being 36m at the time. The building comprises 66 apartments and is referred to as Stage 1.
Mar 2013	Following exhibition and receipt of public submissions, Council resolves not to proceed with the Planning Proposal.
Apr 2013	Council resolves to rescind the March 2013 decision, and resolves to approve the Planning Proposal, however with a reduced height of the tower from 78m to 65m. It also resolves not to permit any additional height without Loftex entering into a Voluntary Planning Agreement (VPA) to fund construction of the proposed plaza over the railway line adjacent to the site. Loftex did not offer a planning agreement at the time.
May 2013	The JRPP approves the Stage 1 DA at the western end of the site.

2 Background

Date	Event
Sept 2013	The DoPI publishes the amended Lane Cove LEP (Amendment No. 11) with a reduced building height of 65m for the tower despite written submissions by Loftex that it effectively downzones the site by reducing the ability to achieve the FSR originally set for the site by the DOPI. The published amendment also reduced the building height for the remainder of the Site from 36m to 25m.
Sept 2013	Council makes site specific amendments to the Lane Cove DCP that further reduces the available floor space on the site by increasing setbacks for the tower and requiring commercial space at the future plaza level. The DCP directly reduces the ability to achieve the FSR applying to the Site.
Nov 2013	In response to further written submissions from Loftex following gazettal, DoPI write to explain their decision, and encourage Loftex to liaise with Council and enter into a VPA plus seek increased building height via a Clause 4.6 variation to the height control when a DA is lodged for the tower.
January 2014	The Stage 1 building construction commences and any recouping of gross floor area on that part of the Site has now been lost.
September 2014	Loftex lodges a DA for Stage 2 of the site comprising a low rise building plus a tower of 94m in height, accompanied by an offer to enter into a VPA. The VPA would deliver approximately $8.3 million to Council. The total number of apartments proposed is 269 (which in addition to the 66 apartments approved in Stage 1 bring the total of dwellings for the entire site to 335). The additional height of the tower is required to compensate for lost building envelope from the LEP and DCP amendments by Council but was still compliant with FSR controls for the Site (i.e. no extra floor space was sought).
March 2015	Council recommends the Stage 2 DA for approval, subject to conditions. In addition, Council execute the VPA.
19 March 2015	JRPP refuses the DA on the grounds that the Clause 4.6 variation cannot be supported for a number of technical reasons. The VPA was given little weight in their consideration of the matter. Section 2.2 provides further discussion on the DA and the JRPP determination.
20 April 2015	Council resolves to support a new Planning Proposal to increase the building height on the eastern (tower end) of the Site to 94m as well as enter into a new VPA on the same terms as the one previously executed.
28 May 2015	Planning Proposal submitted to Lane Cove Council.
14 August 2015	Gateway Determination issued.
16 October 2015	Planning Proposal placed on public exhibition. Exhibition period closed on 26 November 2015.
7 December 2015	Council resolved to adopt the Planning Proposal and proceed to publishing the amendment to the Lane Cove LEP.

2 Background

2.2 Previous Development Application (DA14/143)

Following the making of Amendment No. 11 to Lane Cove LEP 2009 in September 2013, Loftex submitted a DA for a proposed Mixed Use Development at 1-13 Marshall Avenue, St Leonards. The development comprised a low rise building comprising a 6 to 7 storey scale building and a high rise building at the eastern end of the site of 29 levels (from Marshall Avenue) plus roof plant. The development also included a 3 level basement car park.

A Planning Agreement accompanied the DA which offered a monetary contribution of approximately $8.3 million towards public infrastructure, namely the St Leonards Plaza over the railway line.

Due to the combined effect of the LEP amendment and development control plan (DCP) amendments that reduced the development potential of the site, the DA proposed a building of 94m in height. This height reinstated the achievable gross floor area that previously existed before the publishing of Amendment No. 11 to the LEP. As suggested by the DoPI at the time, a clause 4.6 variation was submitted to justify the departure from the 65m building height development standard of the LEP.

The DA was assessed by Council's planning staff and determined by the Sydney East Joint Regional Planning Panel (JRPP) due to the cost of work exceeding $20 million. The Council's planning staff recommended approval of the DA subject to conditions.

The JRPP refused the DA for a number of reasons primarily relating to the proposed development exceeding the 65m building height development standard and the accompanying Clause 4.6 Variation which was not able to be supported under the planning framework applying at that time. A Planning Proposal was subsequently submitted to amend the building height development standard to 94 metres and in doing so addresses the JRPP's issues regarding height non-compliance. The merit issues of height (e.g. character, transition in scale, view impact and shadow impact) are addressed in this SEE.

A VPA accompanies the most recently submitted Planning Proposal and is intended to be executed before the determination of this DA. The proposed development does not rely upon clause 4.6 and therefore the VPA can be considered and given determinative weight when assessing the DA.

2.3 Stage 1 DA

On 9 May 2013, the Sydney East Joint Regional Planning Panel approved a development application for a mixed use development comprising a small retail/commercial tenancy and a residential flat building comprising 66 dwellings for land known as 15-25 Marshall Avenue. The approved building comprises a 2 and 3 level basement car park and 6 - 8 storey building above the basement. This development is Stage 1 of the redevelopment of the street block bound by Marshall Avenue, Berry Road, Marshall Lane and Canberra Avenue. Construction of the Stage 1 building is due to be completed in December 2015.

The development the subject of the SEE is referred to as Stage 2. The subject development has been designed as a continuation of the approved development.

2.4 Other applications

For contextual purposes, Loftex has or will be submitting an application and road opening permit to re-route a stormwater pipe that traverses the site. The stormwater pipe is not the subject of an easement or noted on title. The pipe will be re-routed around the perimeter of the site to avoid it being suspended through the basement. The re-routing of the stormwater pipe is shown on the Stormwater Layout Plans (**Appendix 8**) for contextual purposes.

3 Site Context

3.1 Location

The subject site is located within the Lane Cove Local Government Area and is known as 1-13 Marshall Avenue with a legal property description of Lot 100 DP 1200133 as illustrated in **Figure 1a**.

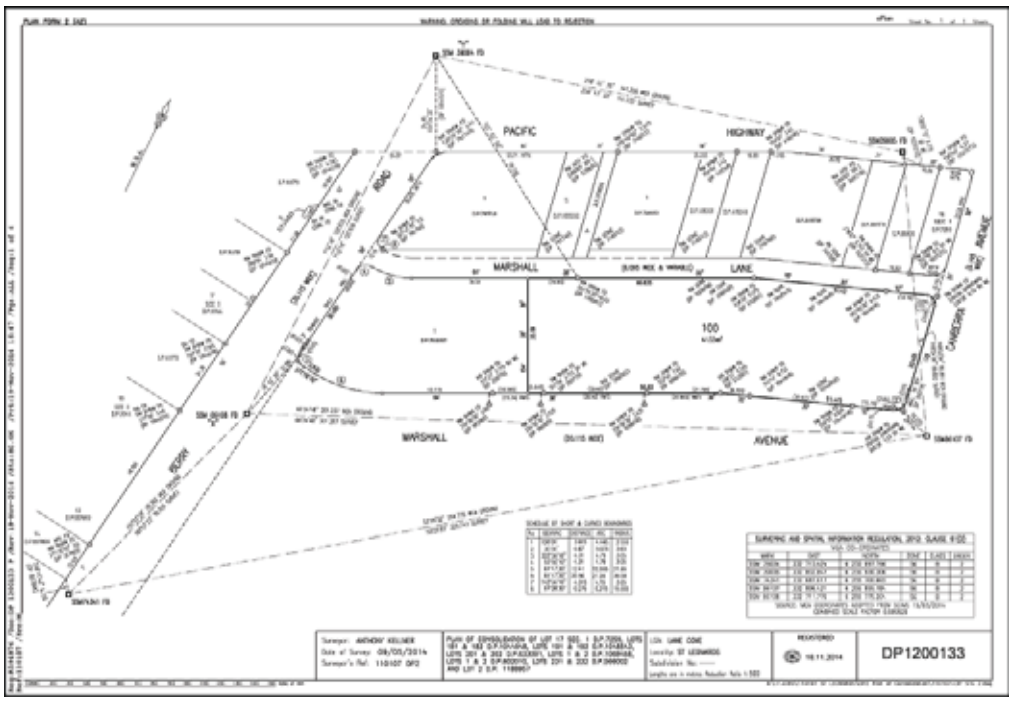

Figure 1 a. Subject Site

Figure 1b shows the location of the site in relation to the broader St Leonards area (the location of the subject site with a red outline). The site has frontages to Marshall Avenue, Marshall Lane and Canberra Avenue and shares the boundary with the Stage 1 DA site.

Figure 1 b. Site Location

3 Site Context

3.2 Site Description

The site has three (3) road frontages, Marshall Avenue, Canberra Avenue and Marshall Lane. The frontage to Marshall Avenue is approximately 108m and the site has a depth (Canberra Avenue frontage) of 34-35m. The site has an area of 4133m^2 as per the Deposited Plan at Figure 1a.

The site has a southern slope falling from Marshall Lane to Marshall Avenue. The land also falls from Canberra Avenue to the west and also falls from Berry Road to the east, resulting in a low point about 40m west of the intersection of Marshall Avenue and Canberra Avenue.

The eastern end of the Site has been cleared of the former dwelling houses and vegetation. A sales centre and car park now occupy the Site. Due to the slope of the land the former houses that occupied the site were all elevated above street level and the front boundaries contained substantial retaining walls and fencing which formed the streetscape character. Those retaining walls remain in place, but will be replaced as part of the proposed works.

The western end of the site is a construction site for the Stage 1 building which is due to be completed in December 2015.

Figures 2 to 4 are photographs of the subject site viewed from the three street frontages. The site has been cleared of the former dwellings and vegetation under development consent DA 226/2012 approved on 24 March 2013.

Figure 2 Marshall Avenue street frontage (looking west from Canberra Avenue)

3 Site Context

Figure 3 Marshall Lane street frontage (looking east)

Figure 4 Canberra Avenue street frontage

3.3 Surrounding Development

The subject site is located on the south-western fringe of the St Leonards commercial precinct within a 250 metre radius of the station. The site is also located near a strategic bus corridor as identified in the draft Inner North Subregional Strategy.

Figure 5 on the following page is a photographic site analysis illustrating the surrounding development. **Figure 6** illustrates the surrounding land uses and approximate heights of existing buildings in the surrounding area.

Photo 1: Looking north up Canberra Ave adjacent to the site

Photo 2: Railway corridor to the east of the site

Views key map

Photo 8: Apartment buildings up to 7 storey scale in Duntroon Ave

Photo 7: 2 & 3 storey scale retail/commercial development adjacent to site

Photo 3: Marshall Lane looking west

Photo 4: Examples of detached houses in Holdsworth Ave

Photo 5: Typical house on southern side of Marshall Ave

Photo 6: View south along Herbert St (tower will terminate the vista)

Figure 5 Photographic Site Analysis

3 Site Context

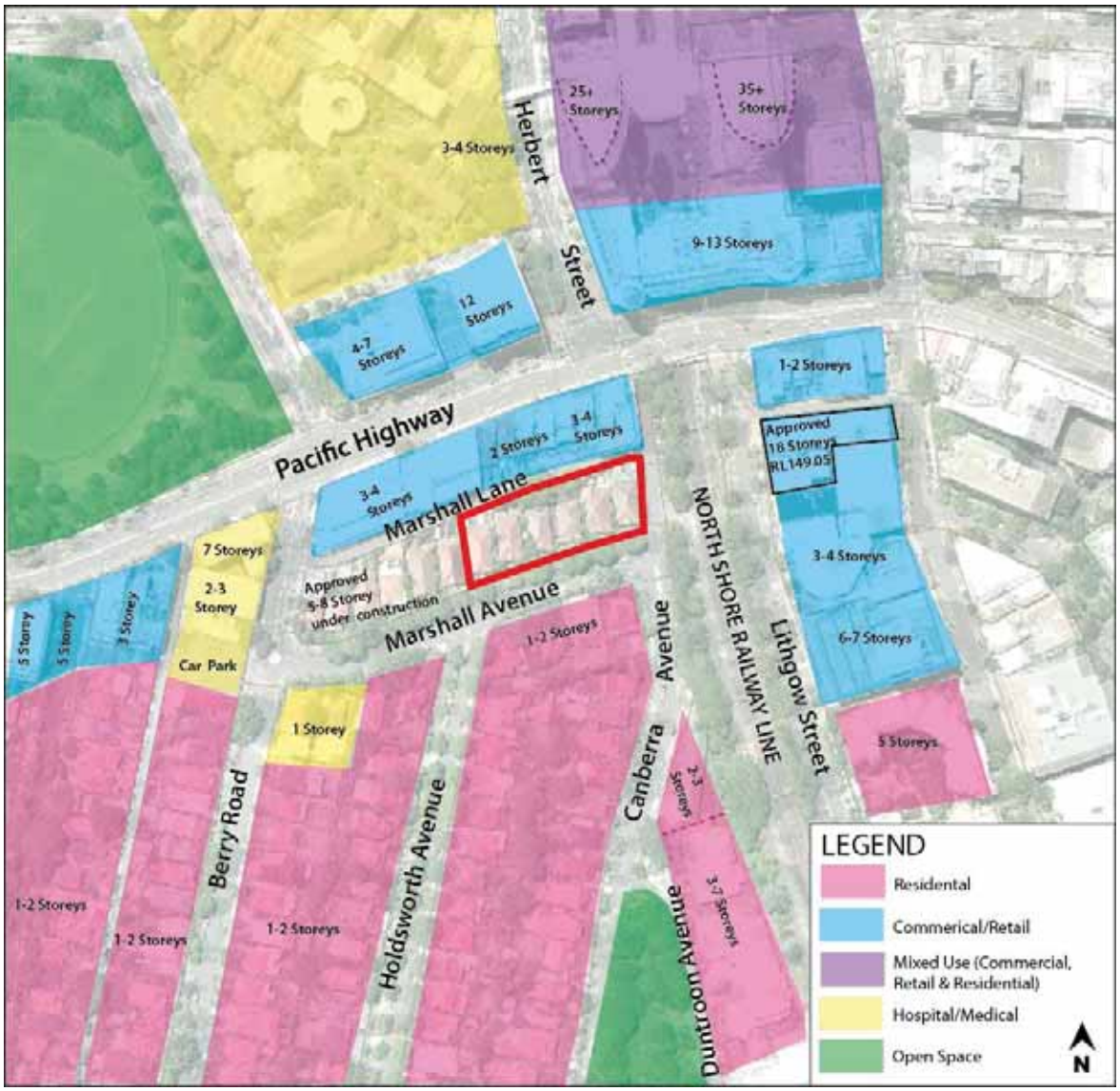

Figure 6 Surrounding land uses and heights of existing buildings

Surrounding development comprises:

- Commercial / retail development on the opposite side of Marshall Lane and fronting the Pacific Highway ranging in scale from 2 to 4 storeys.
- On the northern side of the Pacific Highway is commercial development ranging from 4-13 storeys and behind are the Forum residential high rise buildings at 25 and 35+ storeys.
- The North Shore railway line to the east is in a cutting. Beyond the railway line along Lithgow Street is commercial development currently of 3-7 storey scale. A DA was approved on 84-90 Christie Street and 75-79 Lithgow Street for an 18 storey commercial building to RL 149.05 (equating to approximately 25 residential storeys).
- To the south is residential development comprising single and two storey detached houses. Single and two storey residential development extends south along Canberra Avenue and Holdsworth Avenue.
- Further to the south along Duntroon Avenue (approximately 150m from the subject site) is a residential flat building development ranging in scale from 3 to 7 storeys.

3 Site Context

- Commercial development to the west at the corner of Berry Road and Pacific Highway of 3 to 7 storey scale transitioning to lower scale residential away from the Pacific Highway.

As discussed in **Section 5.2.2**, the area is in transition and likely to undergo further change, most notably in terms of building scale.

3.4 Surrounding Road Network

The surrounding road network is characterised by the following:

- The Pacific Highway which is a classified road is located approximately 45m to the north of the subject site. The subject site does not have frontage to the Pacific Highway.
- River Road to the south is a major road. The only connection with River Road is Canberra Avenue and Duntroon Avenue both with restricted movements.
- Berry Road is a local road which comprises the western boundary of the original site. Berry Road connects the site and immediate locality with the Pacific Highway. The intersection of Berry Road and Pacific Highway is a traffic controlled intersection permitting all movements into and out of the immediate area.
- Marshall Avenue is a local road and forms the main frontage to the site. It connects other local roads such as Canberra Avenue and Holdsworth Street with the Pacific Highway via Berry Road.
- Canberra Avenue is to the east of the site. This section of Canberra Avenue terminates just north of Marshall Lane and does not provide a vehicular connection to the Pacific Highway.
- Marshall Lane is a narrow laneway forming the northern boundary of the site. It currently provides vehicular access to the subject site and rear lane service and parking access for the Pacific Highway shops and commercial properties. It is one-way east bound.

Canberra Avenue and Berry Road are the main pedestrian connections from the residential area to the Pacific Highway.

On street parking is available in the local residential streets, however some of it is time-limited owing to its proximity to the St Leonards railway station, buses, employment and Royal North Shore Hospital.

4 Proposed Development

4.1 Overview

The proposed development involves the construction of a mixed use development comprising two buildings sited over a common 3 level basement car park.

A low rise building comprising a 6 to 7 storey scale building plus roof plant is proposed on the western part of the site. This building will be entirely residential and is a continuation of the approved Stage 1 building in terms of its architectural design, setbacks and materials.

A high rise building is proposed at the eastern end of the site which will contain 29 levels (from Marshall Avenue) plus roof plant. The high rise building will have a different architectural expression from the remainder of the buildings on the site. The high rise building will also contain the mixed use component, with commercial/retail tenancies facing Canberra Avenue.

Appendix 2 contains architectural plans prepared by Nettletontribe Architects.

The following subsections provide a more detailed description of the proposed development.

4.2 Building Form and Design

Marshall Avenue (Low Rise Building)

The low rise building has a two storey scale edge along Marshall Avenue and is setback 3m from the property boundary consistent with the approved Stage 1 building. The presentation to Marshall Avenue comprises two storey townhouse style apartments each with their own pedestrian entrance from the footpath and a basement wall which protrudes due to the slope of the site. The basement wall and courtyard wall to the townhouses are proposed to be clad in sandstone providing a 'base' to the building. This design feature matches the sandstone base of the approved Stage 1 building and is a contextual response to the sandstone foundations and fencing of the existing houses on the site and across the street.

The upper 5 storey component which forms the majority of the building mass, sits on top of the base and steps back in excess of 10m and up to 15m from the Marshall Avenue property boundary. This is to locate the massing as far away from Marshall Avenue as possible to minimise impact on the existing houses.

The elevations are provided with a large degree of modulation with a stepped building form, and articulation through use of balconies of varying sizes, framing, sandstone base, different window sizes and varied building materials including stone, rendered masonry, glazed and masonry balconies and aluminium screening. This is consistent with the approved Stage 1 building and the high degree of modulation and articulation will create a unified and interesting architectural contribution to the streetscape and future character of the area.

Marshall Avenue and Canberra Avenue (high rise building)

The base of the high rise building is expressed in a similar manner to the low rise building with a 3 storey podium that contains apartments each with their own pedestrian entrance from the footpath. The main pedestrian entrance to the high rise building will be from Marshall Avenue which will keep all residential pedestrian movements in Marshall Avenue.

The Canberra Avenue presentation continues with the theme of a sandstone podium base to the building, although due to the slope of the land, the podium presents as two levels upslope and its return around into Marshall Lane.

The level immediately above the podium is recessed from the high rise building above providing a sense of separation between the podium and the high rise building. The recess relates to the future public plaza. Above the podium is a high rise building with 26 levels. The high rise building has a different architectural expression compared to the low rise buildings. A greater use of glazing has been employed to take advantage of significant views.

4 Proposed Development

Marshall Lane

Servicing is provided directly from the lane. Each building will be provided with its own access to garbage storage, residential storage, meter rooms, substation and a shared zone for garbage collection and removalist vehicles for each building.

The low rise residential component will be elevated above the laneway and will present as 5 storeys to the lane. The building setback between 3m and 6m from the laneway property boundary is consistent with the setbacks of the approved Stage 1 building, and similar in scale to the Stage 1 building which will provide continuity in the form and presentation to the lane.

A 3m wide public footpath is provided along Marshall Lane connecting to the footpath to the west (Stage 1) providing a continuous footpath along the length of the laneway.

4.3 Residential Apartments

Table 2 provides a summary of the dwelling mix and approximate floor areas for each dwelling type.

Table 2 Dwelling Summary

APARTMENTS	Number (low rise)	Number (tower)	Total (low rise + tower)	Approximate floor area
Studio	0	21	21 (8%)	40 to 42m^2
1 bedroom (including 22 adaptable)	18	80	98 (36%)	52 to 57m^2
2 bedroom (including 17 adaptable)	24	89	113 (42%)	73 to 107m^2
3 bedroom (including 15 adaptable)	10	27	37 (14%)	102m^2 to 155m^2
Total	**52**	**217**	**269**	

The principal pedestrian entry to both buildings is provided from Marshall Avenue. The letter boxes for all apartments will be adjacent to these building entrances.

4.4 Retail/Commercial Tenancies

The high rise building will contain retail/commercial tenancies at Level 1 (123m^2) and Level 3 (167m^2) with a combined floor area of 290m^2. The uses of the tenancies are not known at this stage of the development, and will be subject to separate applications.

Level 1 relates to the current ground level to Canberra Avenue and the space is designed to have an active frontage to Canberra Avenue. Additional commercial floor space is provided at Level 3 which will activate and connect with the future plaza level as required by Lane Cove DCP 2009. The Level 3 tenancy also has the ability to provide an alternate residential entry to the high rise building which will activate the plaza. Council's vision for the new plaza shows this to be elevated above the current level of Canberra Avenue.

4.5 Vehicular Access, Parking and Loading

A multi-level basement car parking area is to be provided with a vehicular entrance from Marshall Avenue. The driveway will be located at the western end of the site as per the location specified in the DCP. This entrance will require the removal one street tree (a Casuarina). The proposal provides 291 car parking spaces (residential, visitors and commercial), 19 motorbike spaces, 1 car wash bay, 1 car share space and 104 bicycle spaces.

4 Proposed Development

Two 'shared zone' bays are to be provided off Marshall Lane, each approximately 20m in length and 2.5m wide (within the subject site) or 3m wide from the existing kerb line. These have been located to provide convenient access for garbage collection as well as accommodating removalist vehicles as they connect directly to service corridors into each building.

4.6 Landscaping

Landscaping of the proposed development is illustrated in the landscape plans prepared by Site Image and attached at **Appendix 3.** The landscape opportunities reflect the mixed use nature of the site and its context on the fringe of a commercial area. The majority of landscaping is proposed on structure which is an outcome of the DCP controls to require a podium.

A common open space of 435m^2 is provided between the low rise and high rise buildings located on the podium at Level 1. The space includes passive recreation and seating areas in a landscape setting. A common room is also provided in level 1 of the low rise building which connects directly with the communal outdoor space.

The communal outdoor space and its facilities will only be accessible by the residents of the low rise and high rise buildings. It is not a facility to service the approved Stage 1 building.

Side boundary landscaping is provided at the western edge of the site (adjacent to the Stage 1 approved building) to provide for privacy between the buildings. Marshall Avenue will contain some planting adjacent to the footpath between the proposed buildings and at the vehicular entrance.

4.7 Stratum subdivision

A 2 lot stratum subdivision is proposed. Proposed Lot 1 relates to the high rise building and Proposed Lot 2 to the low rise building. An easement for access to shared facilities (e.g. communal open space and common facilities) will be created to ensure occupants in both stratum lots have legal access to those facilities. An easement for services and use of fire stairs and passages will also be created.

The stratum enables separate owners corporations to be created for the low rise and high rise buildings. The management, raising of levies and operating costs will therefore be separated for each building which is necessary as each building will have very different maintenance requirements and costs due to their different construction and services.

4.8 Planning Agreement (VPA)

Loftex has offered to enter into a Planning Agreement under Section 93I(3) of the EPA&A Act with Lane Cove Council in conjunction with the Planning Proposal. The offer to Council is for a monetary contribution of $1,300 per m^2 of gross floor area located above the 65m height limit (reflecting the current 65m building height control and the previous VPA offered by Loftex in relation to the refused DA).

The Planning Agreement sets out that the VPA will not exclude the application of s94, s94A or s94EF of the EP&A Act, and that the amount payable under the VPA will be in addition to any contribution payable under the Council's s94 or s94A Contributions Plan (in this case a s94 Contributions Plan). Therefore s94 contributions will also be levied on the units above 65m.

The payment will be made for the purposes of contributing towards the funding of the construction of a new public plaza over the railway line in St Leonards. The terms of the VPA are such that the Planning Agreement will not become operational until Lane Cove LEP 2009 is amended and therefore prior to consent being granted.

4 Proposed Development

We recommend that the following condition be imposed on the development consent:

> *The Developer is to pay the monetary contribution required by the Planning Agreement entered into on [insert date] in accordance with the terms of the Planning Agreement and prior to the issue of a Construction Certificate for all of any part of the Development.*

4.9 Construction hours

A standard condition regarding construction hours has been imposed on the Stage 1 consent which limits construction hours to 8am to 12noon on Saturday (i.e. 4 hours of work). On a project of this scale, a 4 hour period makes it very difficult to carry out works such as concrete pours and based on experience with the Stage 1 DA, subcontractors have not turned up if they are limited to 4 hours work. To overcome these problems, it is proposed to amend Council's standard condition in relation to permissible working hours to allow work from 8am-2pm on Saturdays.

The standard condition has probably been drafted as most development in Lane Cove Council LGA would occur in predominantly (or entirely) residential areas, such as the recent apartment development in Lane Cove North and apartment development in the residential areas around the Lane Cove town centre. However, the subject site has a different and more commercial context with properties to the north fronting the Pacific Highway being commercial or retail, and similarly properties to the east are commercial in nature and separated by the railway line. The more sensitive residential areas are limited to the south and west.

In addition, construction traffic accessing the site has ready access to the Pacific Highway and does not have to pass through surrounding residential areas, again reducing potential impacts when compared to other localities in the LGA.

Hutchinson Builders has advised that the construction program for this project can be reduced by 4 months if an additional 2 hours of work on a Saturday is permitted. Whilst there would be 2 hours of additional impact on Saturdays, there is an overall benefit of a reducing the construction period by approximately 4 months.

We request that the standard condition be amended to allow work to occur between to 8am-2pm on Saturdays.

> *18. All building construction work, including earthworks, deliveries of building materials to and from the site to be restricted as follows:-*
>
> | | |
> |---|---|
> | *Monday to Friday (inclusive)* | *7am to 5.30pm. High noise generating activities, including rock breaking and saw cutting must not be carried out continuously for longer than 3 hours without a 1 hour break.* |
> | *Saturday* | *8am to 2pm with NO excavation, haulage truck movement, rock picking, sawing, jack hammering or pile driving to be undertaken. Failure to fully comply will result in the issue of a breach of consent P.I.N.* |
> | *Sunday* | *No work Sunday or any Public Holiday.* |
>
> *A Notice/Sign showing permitted working hours and types of work permitted during those hours, including the applicant's phone number, project manager or site foreman, shall be displayed at the front of the site.*

5 Environmental Planning Assessment

This section provides an environmental assessment of the proposed development in respect of the relevant matters for consideration under Section 79C(1) of the Environmental Planning and Assessment Act, 1979 (EP&A Act).

5.1 Planning Controls

The following subsections assess the proposal against the relevant provisions of applicable Environmental Planning Instruments (EPIs), Draft EPIs, Development Control Plans (DCPs), Planning Agreements and matters prescribed by the Regulation in accordance with Section 79C(1)(a) of the EP&A Act.

5.1.1 State Environmental Planning Policy No. 55 – Remediation of Land

Clause 7(2) of the SEPP requires that before determining a DA that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land carried out in accordance with the contaminated land planning guidelines.

In accordance with SEPP 55, Environmental Investigation Services (EIS) has prepared a Preliminary Stage 2 Environmental Site Assessment for the property. A copy of their report is attached at **Appendix 9** and the findings are discussed at Section 5.3.3.

5.1.2 State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Development

Nettletontribe has prepared an Architectural Design Statement which is attached at **Appendix 7**. The Architectural Design Statement addresses the design quality principles of SEPP 65. An assessment against the Apartment Design Guide (ADG) is provided in **Appendix 6**. There are some minor variations to five design criteria of the ADG. The assessment at **Appendix 6** contains the justification for the departures.

Clause 6A of SEPP 65 identifies a number of objectives, design criteria and design guidance in relation to Parts 3 and 4 of the ADG. If a DCP contains provisions that specify requirements, standards or controls in relation to a matter to which clause 6A applies, those provisions are of no effect. The matters to which clause 6A relates includes:

(a) visual privacy (Part 3F),

(b) solar and daylight access (Part 4A),

(c) common circulation and spaces (Part 4F),

(d) apartment size and layout (Part 4D),

(e) ceiling heights (Part 4C),

(f) private open space and balconies (Part 4E),

(g) natural ventilation (Part 4B),

(h) storage (Part 4G).

There are a number of controls in Lane Cove DCP 2009 that contain provisions inconsistent with the ADG. These have been noted in the DCP compliance table at **Appendix 7**. Those controls have no effect.

Clause 30 of SEPP 65 contains standards that cannot be used as a ground to refuse development consent, including:

> *(a) if the car parking for the building will be equal to, or greater than, the recommended minimum amount of car parking specified in Part 3J of the Apartment Design Guide,*
>
> *(b) if the internal area for each apartment will be equal to, or greater than, the recommended minimum internal area for the relevant apartment type specified in Part 4D of the Apartment Design Guide,*

(c) if the ceiling heights for the building will be equal to, or greater than, the recommended minimum ceiling heights specified in Part 4C of the Apartment Design Guide.

In relation to (a), it is noted that the Lane Cove DCP contains car parking provisions (for the residential component) that are greater than the ADG. The proposal meets the ADG requirements, and therefore the consent authority cannot refuse consent for not complying with the greater requirement of the DCP.

In relation to (b) the internal area of each apartment meets the minimum internal area for the relevant apartment type specified in Part 4D of the ADG.

In relation to (c) the ceiling height meet the minimum recommended ceiling heights specified in Part 4C of the ADG.

The DA cannot be refused on the grounds of car parking, internal area of the apartments or ceiling height.

The assessment at **Appendix 7** demonstrates a high degree of compliance with the objectives or design criteria of the ADG. In particular the proposal complies with the design criteria relating to residential amenity (e.g. visual privacy and building separation, 70% solar access, 60% natural ventilation, ceiling heights, apartment sizes). There are some minor variations that are justified in the compliance table.

5.1.3 State Environmental Planning Policy (Infrastructure) 2007

Clause 86 – Excavation in, above, or adjacent to rail corridors

Clause 86 applies to development that involves the penetration of ground to a depth of at least 2m below ground level (existing) on land:

- within or above a rail corridor, or
- within 25m (measured horizontally) of a rail corridor. or
- within 25m (measured horizontally) of the ground directly above an underground rail corridor.

In this case, the proposed development involves excavation to a depth of approximately 15m within 25 of the rail corridor.

Under subclause (2), the Council will be required to refer the DA to Sydney Trains within 7 days of receiving the DA and take into consideration any comments received within 21 days after that notice has been given. The Council cannot determine the DA until Sydney Trains' concurrence has been received (unless the 21 day period has passed or Sydney Trains has refused to provide its concurrence).

The previous (refused) DA was referred to Sydney Trains for concurrence. Sydney Trains granted its concurrence to that DA subject to a number of deferred commencement conditions. Loftex has prepared further documentation and assessments to address the previous deferred commencement matters. A package of information was provided to Sydney Trains on 8th September 2015 and included the following:

- Acoustic report prepared by Renzo Tonin (copy provided at **Appendix 12**)
- Rail Corridor Risk Assessment prepared by Hutchinson Builders (**Appendix 10**)
- Electrolysis Testing Report prepared by Corrosion Control Engineering (**Appendix 10**)
- Geotechnical Assessment of Impact of Proposed Residential Development on Sydney Trains Infrastructure prepared by Parsons Brinckerhoff (**Appendix 10**)
- Geotechnical Investigation prepared by JK Geotechnics (**Appendix 11**)
- Survey Plan showing selected railway line detail prepared by Denny Linker & Co (**Appendix 10**)

- Structural drawings and reports prepared by Pile Design Solutions (**Appendix 10**)

Discussion regarding the geotechnical considerations of the proposed development on the adjoining railway corridor (including planned quadruplication of the existing tracks and the planned CBD Rail Link tunnelling) is provided at Section 5.3.4 of this SEE.

Clause 87 – Impact of rail noise or vibration on non-rail development

Clause 87 relates to residential building on *land in or adjacent to a rail corridor that the consent authority considers could be adversely affected by rail noise or vibration*. Where a residential building is proposed, subclause 3 sets the following acoustic criteria

> *(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
>
> *(a) in any bedroom in the building—35 dB(A) at any time between 10.00 pm and 7.00 am,*
>
> *(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*

The consent authority is also required to take into consideration any guidelines.

Renzo Tonin has prepared an acoustic report that assesses the effects of road and rail noise and vibration on the proposed residential building having regard to the above acoustic criteria and the *Development near rail corridors and busy roads: interim guideline,* prepared by the then Department of Planning, 2008. Acoustic considerations are discussed in Sections 5.2.6 and 5.2.7 of this SEE.

Clause 102 - Impact of road noise or vibration on non-road development

Clause 102 applies to development for residential purposes on land in or adjacent to any road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration.

The Pacific Highway carries in excess of 40,000 vehicles per day. The site is not adjacent to the Pacific Highway with commercial development separating the site from the road. The provisions of the SEPP have nevertheless been considered to ensure that the construction standard and building materials improve residential acoustic amenity.

Renzo Tonin & Associates has prepared an Acoustic Assessment report addressing traffic noise impacts and insulation required to achieve internal acoustic amenity. A copy of their report is attached at **Appendix 12**. Further discussion is provided in Section 5.2.6.

Clause 104 - Traffic-generating development

Clause 104 sets out the criteria for traffic generating development and requirements for referral of certain DAs to the RMS.

The proposal has greater than 200 car parking spaces ancillary to the residential and commercial/retail components. The development is therefore of a size and capacity that requires referral of the application to the RMS under Column 2 to Schedule 3 of the SEPP.

Traffix has prepared a Traffic Impact Assessment that is attached at **Appendix 14**. Further discussion on traffic related matters is provided at Section 5.2.10.

5.1.4 State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

A BASIX Certificate has been prepared by BASIX Certificate Centre for the proposed development which is attached at **Appendix 21**. A copy of the BASIX certified plans is submitted separately. The Certificate confirms that, subject to certain commitments, the proposed dwellings are capable of meeting or exceeding the water, thermal comfort and energy targets.

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5.1.5 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

SREP (Sydney Harbour Catchment) 2005 is a deemed SEPP. The site is located within the Sydney Harbour Catchment, but is not identified as being within a 'Foreshores and Waterways Area'. Nor is it a strategic foreshore site, a heritage item or a wetlands protection area.

Clause 13 of the SREP contains a set of planning principles for the Sydney Harbour Catchment. The site is an urbanised area which is zoned to encourage redevelopment to higher density. The main considerations of the SREP of relevance to this site and the proposed development relate to stormwater management and water quality. Wood and Grieve Engineers has designed a stormwater management system for the site. Their plans are attached at **Appendix 8**. The system includes an 110,000 litre on-site detention tank through which most of the water collected from the building and site will be directed before being discharged to the Council's stormwater system. A rain water tank is also proposed. These tanks will assist with water quality control (such as a debris screen) and regulation of water volumes being discharged from the site. Wood and Grieve Engineers has also prepared a sediment and erosion control plan and this is also attached at **Appendix 8**.

The Preliminary Stage 2 Environmental Assessment prepared by EIS (**Appendix 9**) also considered impacts to groundwater (which would drain to Gore Cove). They concluded that the potential for the contaminants to impact the groundwater is considered to be low.

5.1.6 Lane Cove Local Environmental Plan 2009

Zoning

The subject site is zoned B4 – Mixed Use under Lane Cove LEP 2009. A copy of the zoning map is shown at **Figure 7**.

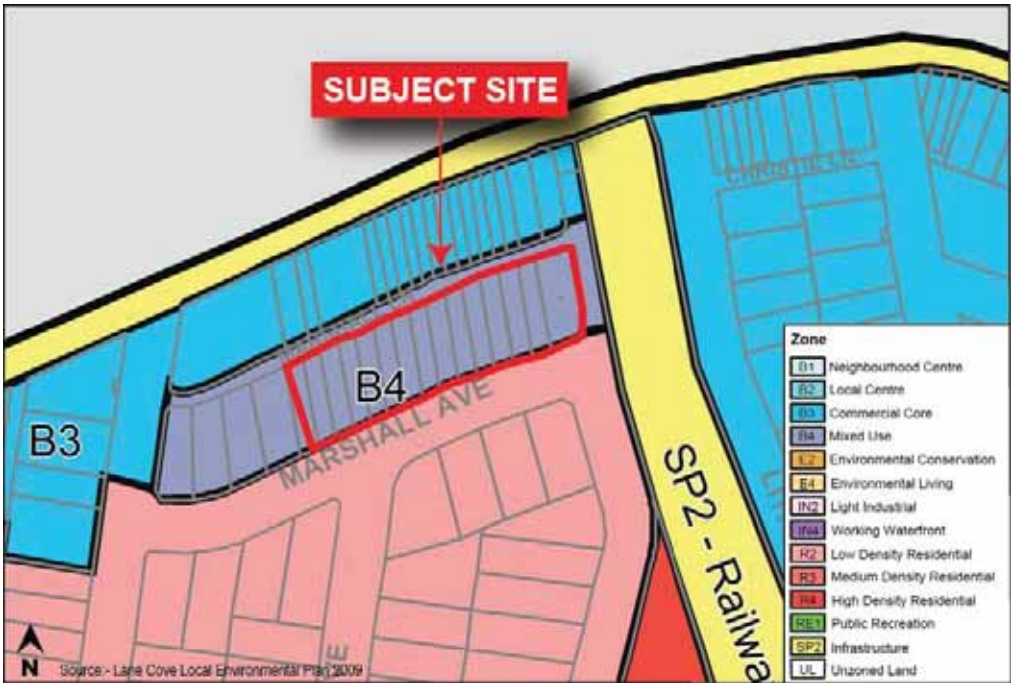

Figure 7 Zoning Plan Extract – Lane Cove LEP 2009.

The proposed development is permissible with consent as *residential flat buildings* and *commercial premises*.

The objectives of the B4 – Mixed Use zone are:

- *To provide a mixture of compatible land uses.*

- *To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling.*
- *To encourage urban design maximising attractive public domain and adequate circulation space for current and future users.*
- *To maximise sunlight for surrounding properties and the public domain.*

The proposal is capable of achieving the zone objectives by:

- Incorporating a commercial/retail tenancy addressing the Canberra Avenue frontage at the current ground level (and future ground level of the plaza) that will integrate potential business, office or retail uses close to public transport and the space could function well with commuters walking to/from the railway station.
- The site is highly accessible to public transport including St Leonards railway station and buses operating along Pacific Highway. The provision of additional residential density in this location is consistent with A Plan for Growing Sydney and draft Inner North Subregion Strategy as discussed in Section 5.3.1.
- The building's design has taken into account the surrounding building materials utilising a sandstone base which is continuation of the approved Stage 1 building. This treatment is reflective of the surrounding houses and the existing sandstone foundations and retaining walls on the subject site. A lower 2 to 4 storey scale is proposed along the immediate frontage to Marshall Avenue as townhouse style dwellings to respond to the adjoining houses opposite.
- The building has been designed to integrate with the public domain and provide a consistent treatment to the northern side of Marshall Avenue. A 3 metre wide footpath is provided along Marshall Lane consistent with the Stage 1 approval. The Canberra Avenue frontage has been designed to integrate with the existing ground levels in Canberra Avenue as well as provide adaptability to integrate with the future public plaza being proposed by Council.
- The building has responded to solar constraints by proposing the low rise building (lower than the approved Stage 1 building) and a generous setback to Marshall Avenue to minimise solar impacts to the houses opposite. The proposed high rise building has a narrow built form whilst casting a longer shadow, has a shadow that pass more quickly over the adjoining residential areas.

Height

The subject site has two height controls of 25m and 65m. As noted earlier, that part of the site shown with a 65m building height control is the subject a draft amendment to Lane Cove LEP to increase the building height to 94m. The Height of Building Map has been overlayed with the site plan as illustrated in **Figure 8** to illustrate where the change in building height occurs relative to the proposed building footprints.

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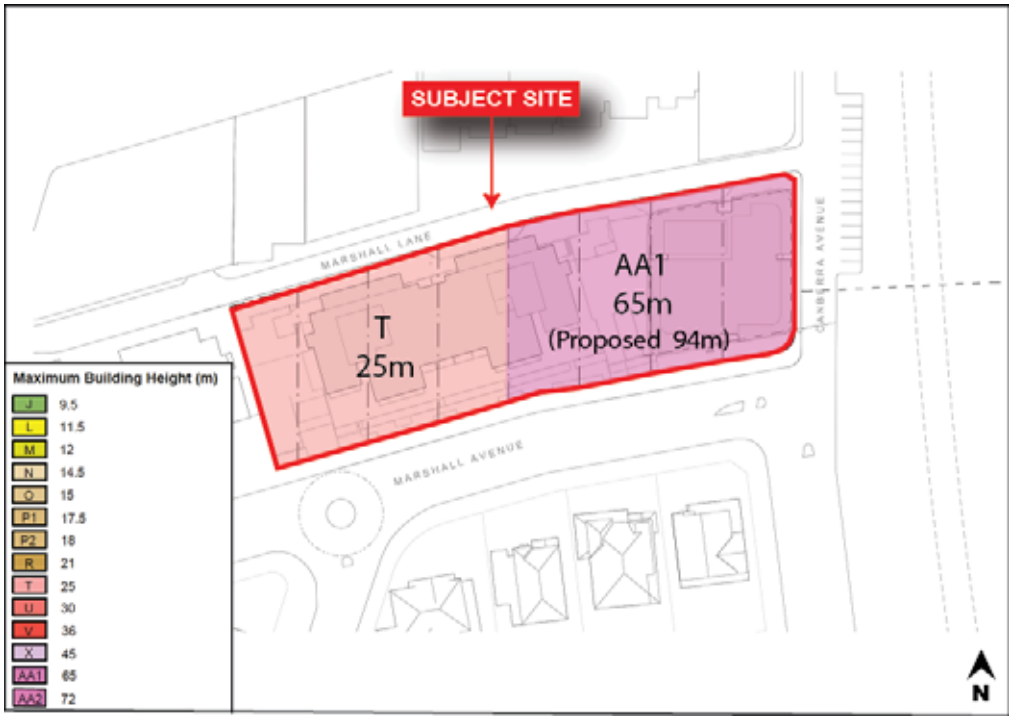

Figure 8 Height of Building Map extract overlayed with the proposed site plan

The low rise building is currently subject to a 25m and 65m building height. The elevations and sections in the set of architectural plans plot the building height line and demonstrate that the low rise building is well within the building height development standards of 25m and 65m and the proposed 94m building height control.

The proposed high rise building is proposed to have a building height of 94m. As discussed earlier the DA is to be determined after the publishing of the amendment to Lane Cove LEP 2009 and that amendment will increase the 65m building height control to 94m. The high rise building complies with the 94m height of building development standard.

Floor Space Ratio (FSR)

The subject site has two FSR controls of 2.5:1 and 10:1. The FSR Map has been overlayed with the site plan as illustrated in **Figure 9** to illustrate where the change in FSR occurs relative to the proposed building footprints.

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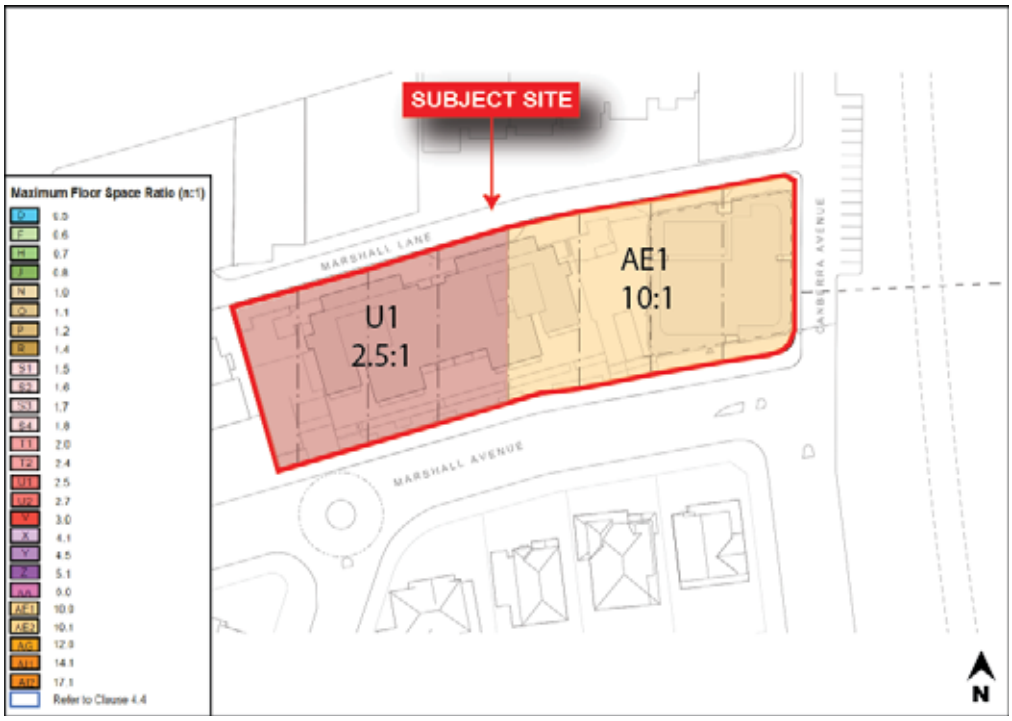

Figure 9 FSR Map extract overlayed with the proposed site plan

A 340.5m^2 portion of the site area (part of 15 and 15A Marshall Avenue) is excluded from the site area for the purposes of calculating FSR as it was used in calculating the FSR for the approved Stage 1 building. A site area of 3795.1m^2 is used for FSR calculations. This site area is split between the FSR boundary as follows:

- 2185.3m^2 is within the 10:1 FSR; and
- 1609.8m^2 is within the 2.5:1 FSR.

The distribution of the FSR relative to the site (as shown on the DCP Block Plan) is represented in **Figure 10**.

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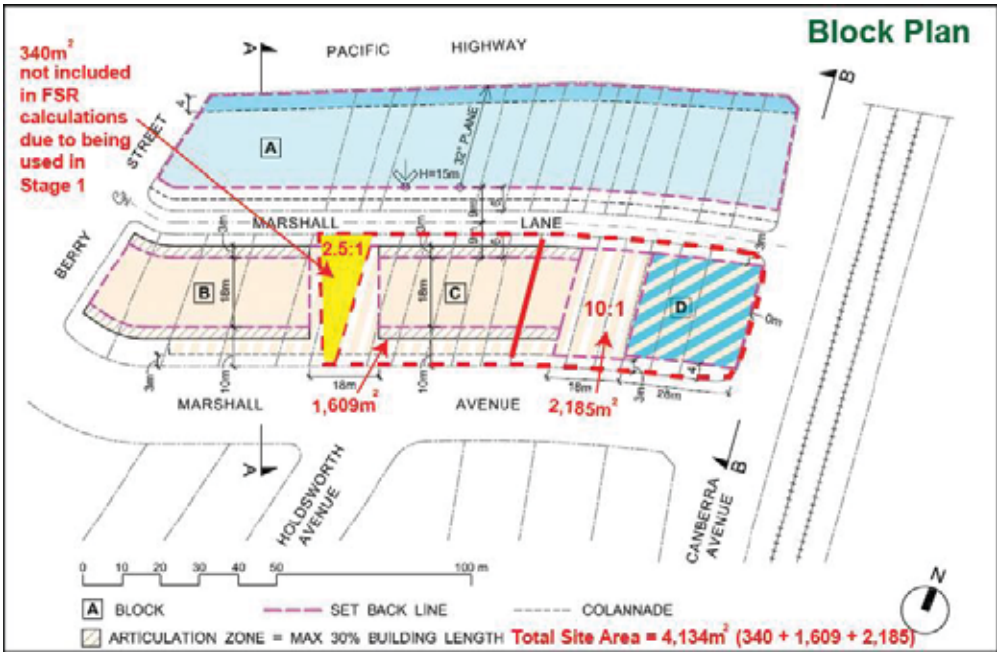

Figure 10 Distribution of FSR relative to DCP Block Plan

Appendix 2 contains a plan illustrating the areas of the building included in the GFA calculation and the split between the two FSR controls. The plans confirm the areas of the building included as GFA. It is noted that the garbage storage areas and some residential storage cages are included as GFA as they are not below the existing ground level (i.e. a basement as per the definition in Lane Cove LEP). Nettletontribe Architects has calculated the GFA of the proposed building as set out in **Table 3** below.

Table 3 Floor Space Ratio Summary

	2.5:1 Component	10:1 Component
Site Area	1,609.8m^2	2,185.3m^2
GFA in Low Rise Building	3,969m^2	1,261m^2
GFA in High Rise Building	0	19,367m^2
TOTAL GFA	3,969m^2	20,628m^2
FSR	**2.47:1**	**9.44:1**

The table demonstrates that the buildings comply with the FSR controls.

Clause 6.1A - Earthworks

Clause 6.1A contains a number of matters to be addressed where earthworks (including excavation) are proposed. The matters for consideration have been addressed elsewhere in this SEE and supporting consultant reports including:

- Geotechnical Assessment (**Appendix 11**) prepared by JK Geotechnics which has considered existing geology, groundwater and recommendations regarding excavation methods and retention of the excavated area. It also contains recommendations regarding dilapidation reports for adjoining properties and monitoring of noise and vibration impacts to nearby properties;
- Preliminary Stage 2 Environmental Site Assessment prepared by EIS has also considered potential contamination of groundwater;

- Geotechnical Assessment by Parsons Brinckerhoff in relation to potential impacts to the adjoining railway infrastructure; and
- Construction and Noise and Vibration Management Plan (**Appendix 13**) prepared by Renzo Tonin that contains recommendations in relation to measures to manage noise and vibration impacts.

No adverse impacts have been identified and recommendations are made to implement management plans to control and monitor impacts during the course of excavation and construction.

Clause 6.7 – Airspace

Clause 6.7 provides as follows:

> *"(1) The objective of this clause is to protect airspace around airports.*
>
> *(2) The consent authority must not grant development consent to development that is a controlled activity within the meaning of Division 4 of Part 12 of the Airports Act 1996 of the Commonwealth unless the applicant has obtained approval for the controlled activity under regulations made for the purposes of that Division.*
>
> ***Note. Controlled activities** include the construction or alteration of buildings or other structures that causes an intrusion into prescribed airspace (being generally airspace around airports). Controlled activities cannot be carried out without an approval granted under regulations made for the purposes of Division 4 of Part 12 of the Airports Act 1996 of the Commonwealth."*

The Obstacle Limitation Surface (OLS) for the site is 156m AHD. The proposal has a height of 166.8m AHD and therefore penetrates the OLS and is accordingly a "controlled activity".

Loftex submitted an application to the Department of Infrastructure and Regional Development in 2014 for approval under the Airports (Protection of Airspace) Regulation 1996. The application related to a building with a maximum height of RL 166.8m ADH which is the same land and building height as currently proposed.

The Department of Infrastructure and Regional Development approved the "controlled activity" subject to the following conditions:

1. *The building must not exceed a maximum height of 166.8 metres AHD, inclusive of all lift over-runs, vents, chimneys, aerials, antennas, lightning rods, any roof top garden plantings, exhaust flues etc.*
2. *Separate approval must be sought under the Airports (Protection of Airspace) Regulations 1996 for any cranes required to construct the building.*
3. *At the completion of the construction of the building, a certified surveyor must notify in writing the airfield design manager of the finished height of the building.*

A copy of the Approval is attached at **Appendix 22**. The approval satisfies Clause 6.7 of Lane Coe LEP and consent can therefore be granted.

5.1.7 Draft Lane Cove Local Environmental Plan 2009

A Planning Proposal was placed on public exhibition between 16 October 2015 and 26 November 2015 which proposes to increase the LEP building height for part of the site from 65 metres to 94 metres. On Monday 7 December 2015 Council resolved to adopt the Planning Proposal for the amendment to Lane Cove LEP and forward the Planning Proposal to the NSW Department of Planning & Environment for finalisation. The Council also resolved to enter in to the Planning Agreement accompanying the Planning Proposal.

The DA is consistent with the Planning Proposal.

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5.1.8 Lane Cove Development Control Plan 2009

Lane Cove Development Control Plan (DCP) No. 2009 came into force on 22 February 2009 and has been amended on several occasions. The sections of the DCP relevant to the proposal are:

- Part A – Introduction
- Part B – General Controls
- Part C – Residential Development
- Part D – Commercial and Mixed Use Development
- Part D – Commercial and Mixed Use Localities (Marshall Precinct)
- Part F – Access and Mobility
- Part J – Landscaping
- Part O – Stormwater Management
- Part Q – Waste Management and Minimisation
- Part R – Traffic, Transport and Parking

Appendix 7 contains tables providing an assessment of the proposed development against the relevant provisions of the DCP and commentary for any proposed variations.

5.2 Likely Impacts of the Development

The following subsections assess the likely impacts of the development in accordance with Section 79C(1)(b) of the EP&A Act.

5.2.1 Desired Future Character

The desired future character of St Leonards has been changing over the last few years with Council and DPE having made a number of strategic planning decisions in the 2 years since the 65m height control for the site was made. Those decisions change the future context of the site. These include:

1. The publishing of Lane Cove LEP Amendment No. 18 on 15 May 2015 that has amended the Height of Building Map as it relates to:
    i. 500-504 Pacific Highway with a maximum building height of RL 227.4 (about 37 storeys) (the Charter Hall site); and
    ii. 472-494 Pacific Highway with a maximum building height of RL 180.46 and RL 264.46 (about 24-34 storeys) (the Leighton site).

The concepts submitted with that Planning Proposal for these sites illustrated three new towers along the Pacific Highway which will significantly change the built form character of the St Leonards precinct.

2. A planning proposal for 84-90 Christie Street and 75-79 Lithgow Street (the Winten site) received Gateway determination on 21 October 2015 and is with Lane Cove Council for implementation. The Planning Proposal proposes two heights relating to two future buildings. A western tower at RL166.80 (27 storeys) matching the height of the proposed high rise tower the subject of this SEE and an eastern tower at RL224 (46 storeys)

The concept drawings submitted with that Planning Proposal for these sites illustrate significant building form on the eastern side of the railway line directly opposite the Site. The buildings would be within the immediate visual catchment of the site. Irrespective of Planning Proposal for 84-90 Christie Street and 75-79 Lithgow Street, there is a Part 3A Concept Plan approval for that site which approved an 18 storey commercial building to a height of 72.4m.

3. In November 2014, North Sydney Council released a Planning Study for Precincts 2 and 3 of the St Leonards/Crows Nest Strategy. These precincts include land close to St Leonards train station. The Study has identified 4 sites capable of development greater than 18 storeys and Council has invited land owners to submit a planning proposal for greater height and FSR.
4. Willoughby Council has received a planning proposal request for land north of the Forum towers for building heights of 137m to 190m (38-55 storeys above a 3 storey commercial podium).
5. Council has recently resolved to prepare a Planning Proposal for the St Leonards South Strategy which encompasses an area bound by the rail line, Park Road (eastern side), Marshall Avenue and River Road. The Stage 1 report identified opportunities for changes in land use and density. Stage 2 comprised a Growth Scenarios Report exploring different options for land uses and density. This was publicly exhibited between 19 December 2014 and 1 May 2015 and was reported to Council on 13 July 2015. Council is currently preparing a planning proposal, as per the resolution. The Strategy aims to increase density close to major transport hubs and centres which is an outcome that would be consistent with *A Plan for Growing Sydney.* The St Leonards South area is likely to undergo significant change in setting, urban context and building scale since previous Council decisions. Further discussion regarding the recent Council resolution and the St Leonards South Strategy is provided below (Section 5.2.2) and **Figure 11** is an extract from the Stage 2 report showing the height and envelopes of the preferred Masterplan illustrating the possible built form outcome.

Figure 11 on the following page shows the location of these five sites/precincts in relation to the subject site.

Figure 11 Desired future character of St Leonards

5.2.2 Transition in Scale

The discussion in Section 5.2.1 regarding the desired future character of St Leonards clearly demonstrates the future change in built form around the site including increased building heights and density. A proposed building height of 94m will sit comfortably within that future built form character of St Leonards.

St Leonards South Strategy and Master Plan

Council commenced investigations into St Leonards South in 2013. St Leonards South is a large precinct on the southern side of the Pacific Highway and has been identified as an area that has the potential for redevelopment given its proximity to a transport hub. The St Leonards Strategy has been undertaken in two parts:-

- Stage 1 Precinct Report; and
- Stage 2 Growth Scenarios Report.

Annand Associates Urban Design (AAUD) prepared a St Leonards South Masterplan Draft as part of Stage 2. The Masterplan was placed on public exhibition with groups of owners within the precinct making submissions for an extension of the Masterplan to Park Road and alternative density options to that presented by AAUD.

The Masterplan was considered by Council at its meeting on 13 July 2015. The Council report notes at page 6 that "*Council will be required under the Metropolitan Strategy to provide increased residential densities around the St Leonards rail station."* The Council report further notes at page 10 that:

> *"The Subregional Plans are currently being prepared by the Department of Planning & Environment. As part of the process, the Department has provided initial population projections for each of the councils of the Subregion which include an indicative 6,000 new dwellings for Lane Cove. Although it is yet to be confirmed, this is expected to include the 3,900 dwellings already planned under LEP 2009 and is likely to increase when the Greater Sydney Commission is formed.*

Council is therefore anticipating having to plan for an additional 2,100 dwellings and St Leonards South Strategy has the capacity to contribute to meeting the current and future housing demands focussed around the St Leonards strategic centre including the existing rail station and bus interchange and the future Sydney Rapid Transit train system contained in *A Plan for Growing Sydney*.

Council at its meeting on 13 July 2015 resolved as follows:

> *"1. Adopt the Draft St Leonards Master Plan with the addition of the area up to Park Road east side (see diagram), subject to the B3 Commercial Core zone west of Canberra Avenue remaining as currently zoned;*
>
> *2. Proceed to the preparation of a planning proposal to amend LEP 2009 in accordance with 1 above;*
>
> *3. Prior to the exhibition of the Draft LEP:-*
>
> *i. Obtain firm commitments from each of the relevant government agencies responsible for the delivery of infrastructure to deliver the required infrastructure, in particular the Department of Education and RMS; and*
>
> *ii. meet with the Department of Education to pursue the commitments to the provision of education accommodation;*
>
> *4. Prepare a draft Development Control Plan to accompany the LEP exhibition that includes controls which:-*
>
> *i. Ensure a transition in built form and setback on the eastern side of Park Road to reduce the impact on the western-side of Park Road;*
>
> *ii. Minimise overshadowing to properties on the southern-side of River Road;*
>
> *iii. Provide parking in accordance with Council's current DCP requirements for parking; and*

iv. *Encourages the open-space for residents in the 'Green Spines / Corridors' to be part of an overall Landscape Master Plan;*

5. *Establish an Expert Design Review Panel to provide assessment and comments for Development Applications, to ensure a high standard of development is upheld.*

6. *Prepare a draft Landscape Master Plan to be incorporated into the DCP;*

7. *Prepare a draft area-specific Development Contributions Plan which includes a suitable provision for Key Worker Housing; and*

8. *Acknowledge and thank:-*

   i. *Council's consultants Annand Associates Urban Design, Cred Community Planning, and HillPDA for the work undertaken for the Draft St Leonard's South Master Plan;*

   ii. *The Community Liaison Committee for their input into the master planning process;*

   iii. *All those who provided input into the Draft Master Plan, both in the informal and formal stages of public exhibition; and*

   iv. *Council staff who worked on the project."*

Council is currently preparing a planning proposal and DCP as per the resolution.

The map referred to in Item 1 of the resolution is reproduced below in **Figure 12**. The Council's resolution has extended the Draft St South Leonards Master Plan with the addition of the area up to eastern side of Park Road.

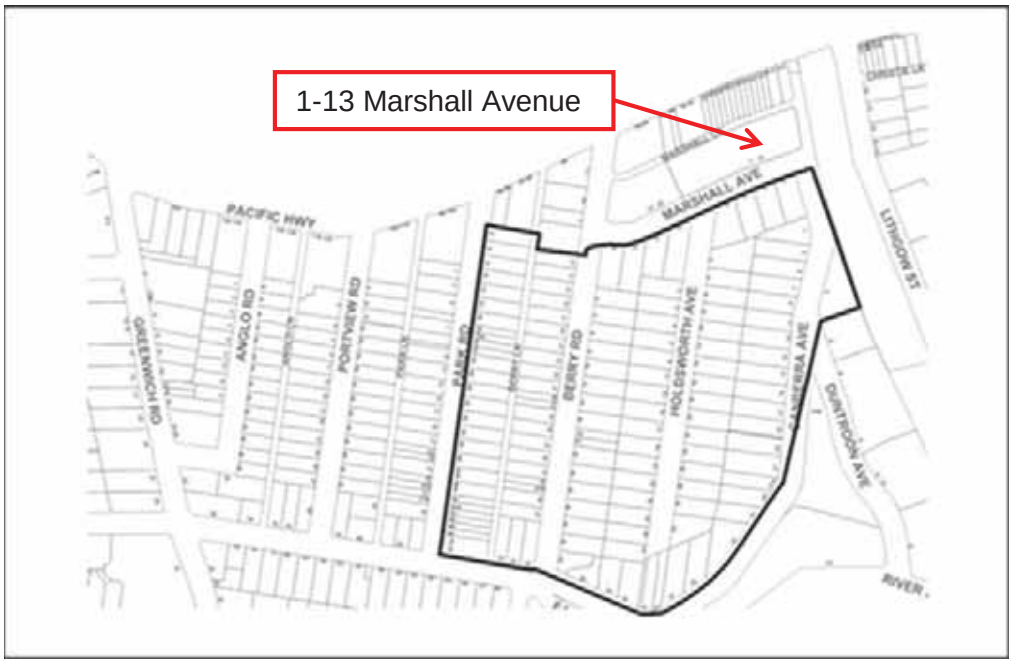

Figure 12 Extent of the St Leonards South Strategy area (source Lane Cove Council Minutes of Extraordinary Council meeting of 13 July 2015

5 Environmental Planning Assessment

The preferred option was for a high density option (as per **Figure 13**).

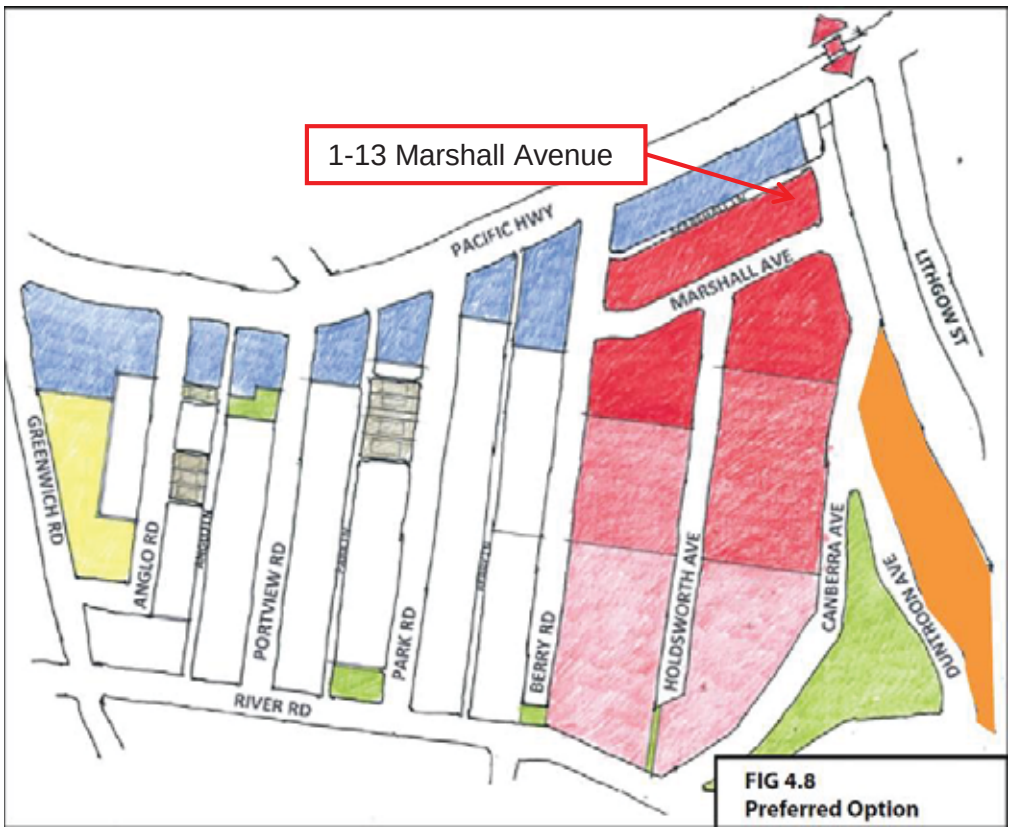

Figure 13 Preferred option high density (concentrated)

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The Master Plan report defined 10 key sites within the Strategy area and investigated the development potential of each key site to test height and FSR controls for each precinct. Site 1 is located on the opposite site of Marshall Avenue between Canberra Avenue and Holdsworth Avenue, as illustrated in **Figure 14 and 15** below.

Figure 14 Site No. 1 of the Stage 2 St Leonards South Strategy Report

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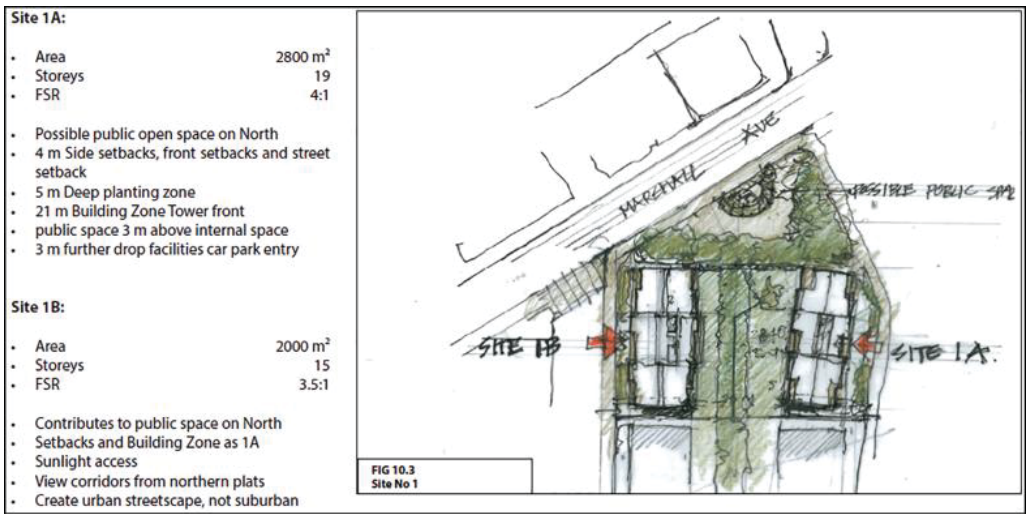

Figure 15 Development Scenario for Site 1

Site 1 is being considered for buildings of up to 15-20 storeys with a FSR of up to 4:1 in light of the Site being proximate to a transport node. Figure 10.3 of the Masterplan (**Figure 15** above) sets out a development scenario for Site 1 with two buildings, one of 19 storeys and the other to the west of 15 storeys in height. These building heights are located directly south of the Site at 1-13 Marshall Avenue.

One of the issues pertaining to this key site as noted in the Masterplan report is "*transitional scale from towers to the North*". The urban design strategy of the Masterplan report is to place taller forms close to the taller buildings permitted by the existing planning controls (including the Site at 1-13 Marshall Avenue) as well as the other development sites east of the railway line. The Masterplan report is clearly responding to the emerging scale context and proposing taller built forms to act as a transition. This is clearly illustrated in the 3D Model presented in the Masterplan report. (Note that the 3D model does not include the extension of the Strategy area to Park Road which was added to Master Plan in the Council's resolution of 13 July 2015). This 3D model is reproduced in **Figure 16**.

The 3D Model does not illustrate the other Planning Proposals and approved developments in the North Sydney and Willoughby LGAs**.**

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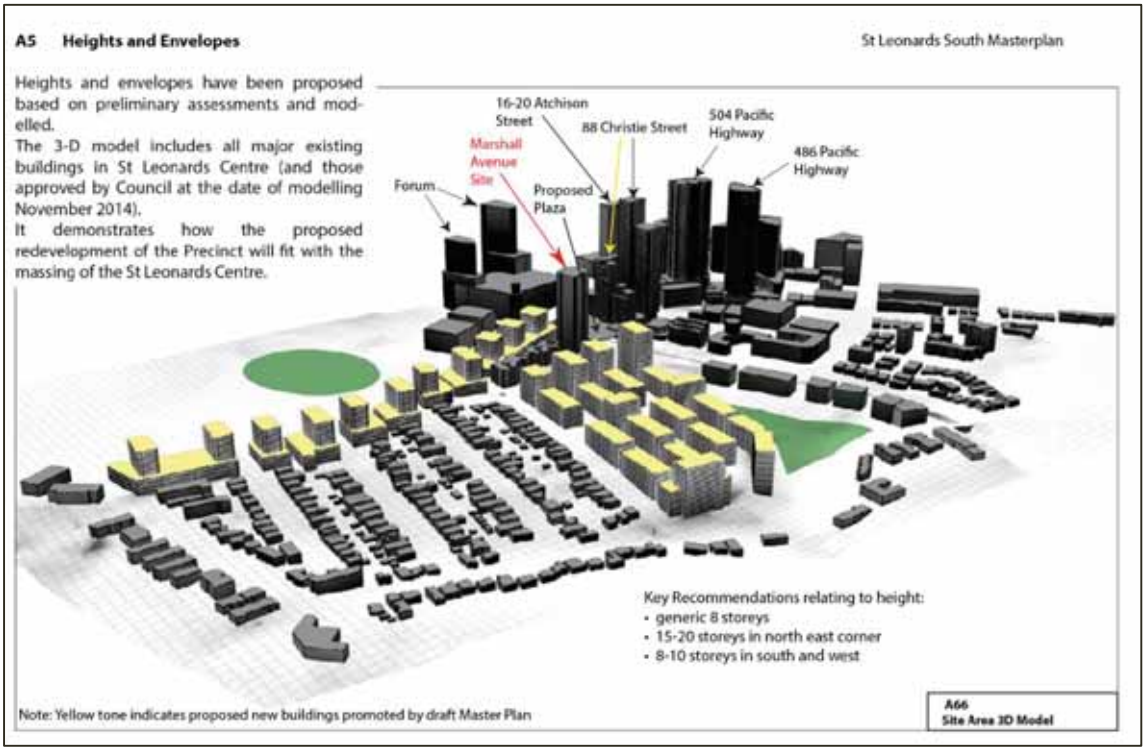

Figure 16 Extract from St Leonards South Master Plan – Preferred Masterplan (annotated by DFP)

The 3D model (**Figure 16**) shows a tower form on the 1-13 Marshall Avenue that appears to be shown at 29 storeys. The model also illustrates some of the recent developments and Planning Proposals in the St Leonards CBD.

The 3D model clearly illustrates the transition in scale from the proposed 94m tower to the scale of development recommended for the St Leonards South Strategy Master Plan area (including 15-20 storeys immediately opposite the site. The 3D model shows higher built form at Marshall Avenue gradually transitioning to lower scale and density towards the south (downslope) before increasing slightly at River Road. The building height of 94m (or 29 storeys) proposed in the Planning Proposal will sit comfortably with the future scale and density envisaged in the St Leonards South Master Plan Strategy.

As per the Council's resolution of 13 July 2015, the Masterplan will require a Planning Proposal. Nevertheless the Council's resolution is an indicator of the planning direction to be pursued by Council and the likely change in built form, scale and height and a 94m high building would sit comfortably within that future context.

If the Masterplan did not eventuate in the form illustrated in **Figure 16**, a building height of 94m would also sit within the context of the surrounding taller buildings, future development of 486-504 Pacific Highway and the Planning Proposal for 88 Christie Street.

5.2.3 Solar Access (Adjacent development)

Nettletontribe has prepared shadow diagrams which are attached at **Appendix 2**. There are two main considerations in terms of shadow impacts:

- The shadow cast on the Marshall Avenue properties, and particularly their northern (front) elevations; and
- Shadows cast on Newlands Park.

Marshall Avenue Properties

The shadow diagrams have been prepared in elevation relative to the northern façade of the houses on the southern side of Marshall Avenue. These are at hourly intervals at mid-winter.

These plans demonstrate that the Marshall Avenue houses will receive at least three hours of sunlight to their northern elevations, with the possible exception of No. 4 Marshall Avenue which is estimated to receive just under three hours of sunlight (this will depend on the internal configuration of the dwelling house which is not known). Aside from a possible departure in respect of No. 4 Marshall Avenue, the proposed development complies with the DCP solar access criteria of 3 hours of sunlight to a portion of the windows of a habitable room between 9am and 3pm on 21 June.

The above assessment is based on the 3 hour control in the Lane Cove DCP 2010. Part 3B – Orientation of the ADG contains Objective B-2 which states that "*overshadowing of neighbouring properties is minimised during mid winter."* The Design Guidance for this objective provides further guidance in terms of how this objective can be achieved, and states that "*living areas, private open space and communal open space should receive solar access in accordance with sections 3D Communal and public open space and 4A Solar and daylight access."*

Design Criteria No.1 to Objective 4A states that "*living rooms and private open spaces of at least 70% of apartments in a building receive a minimum of 2 hours direct sunlight between 9 am and 3 pm at mid-winter in the Sydney Metropolitan Area."* Therefore under the ADG the solar access standard for neighbouring properties in this instance is 2 hours, not 3 hours as per the DCP. In this case, No. 4 Marshall Avenue would comply.

Newlands Park

The public submissions made during the exhibition of the original Planning Proposal in April 2012 commented about shadow impact to Newlands Park. The shadow diagrams (in plan) demonstrate that Newlands Park is not affected by shadows from the high rise building including the additional height proposed above 65m.

5.2.4 Privacy to adjoining residential areas

Privacy impacts to adjoining residential properties are mitigated by the retained street trees and distance separation between buildings.

The town house style apartments at ground and first floor level of both the low rise building and high rise building provide a relationship similar to the former dwelling houses on the site.

The upper levels of the low rise building are setback 10m from the boundary and at a level that is above the ground level of the houses opposite. The street trees on both sides of Marshall Avenue will, at best, allow limited filtered views across to the houses on the southern side of Marshall Avenue. The upper levels will look above the street tree canopy and their outlook will be district or city views.

The upper levels of the high rise building are setback 4m from the Marshall Avenue boundary. Again the retained street trees will provide screening for the lower levels. At upper levels the distance separation to the dwelling houses progressively increases and the outlook from the apartments will be focussed on the district or city views.

Figure 17 is a photograph from a balloon taken at RL 140 (approximately Level 22) illustrating view opportunities. The photograph illustrates that the tree canopy obscures views into private open spaces and that views of houses are largely confined to their roofs. There will also be a large separation between the proposed dwellings and surrounding houses. The contribution of these factors ensures privacy impacts are acceptable.

Figure 17 View from RL 140 (Level 22)

Privacy to the proposed buildings from the commercial properties along Pacific Highway has also been considered and treated in a similar manner to the approved Stage 1 building. The adjoining commercial buildings are 2-3 storeys in scale, so immediate impacts are only at lower levels. Potential impacts are mitigated by the use of aluminium feature screens and solid balustrades to the lower levels. The commercial building would generally only be occupied during working hours Monday to Friday. During the weekday evenings and weekends the commercial buildings are unlikely to be fully occupied. Potential impacts are therefore confined to the day when most occupants of the apartments are also likely to be working.

5.2.5 View sharing

The majority of the site has low rise buildings with the high rise building occupying a small footprint at the eastern end of the site. The proposed buildings will be visible from surrounding building which includes commercial floor space and apartments. Potential view impacts have been considered in relation to:

- The residential dwellings in the Forum East and Forum West high rise buildings;
- The residential dwellings in the Abode apartment building on the corner of Albany Street and Pacific Highway;
- The commercial development located on the northern side of the Pacific Highway; and
- The commercial development located on the southern side of the Pacific Highway (on the opposite side of Marshall Lane).

It should be noted that the recent Planning Proposal for this site to amend Lane Cove LEP 2009 has also considered the view impact of a building of 94m in height. The assessment of view impacts has been undertaken having regard to case law relevant to this issue.

Forum apartments

There is a distance separation of approximately 150m between the Forum and the proposed high rise building. The Forum residential buildings are sited on a north-south axis and taper on the southern end. Balconies to Forum apartments are mainly oriented east or west. It is the west facing apartments located in the south western corner of the two high rise buildings that will be able to see the proposed high rise building.

Photomontages were prepared by Loftex for the 29 storey building proposed in DA 14/143. The images were based on photos taken from various levels of both Forum East and Forum West. The photos were taken by Council officers and appear to have been taken using a zoom lens. The focal length of the lens is not known and some photos have been "stitched" to create a panorama which appears to have caused some distortion. A 94m building envelope on the Site has been superimposed on to the photographs, but due to the zoom lens, the images appear larger in the frame than would have been the case if a 35mm lens was used. However, when the photomontages are compared to the view cones in **Figure 18 and 19**, it can be seen that there is a good degree of correlation between the photomontages and the view cones such that they can be confidently used as an assessment tool.

In all of the photomontages the pink shading presents the additional height between 65-94m which is the subject of the Planning Proposal.

Unit 1701 is located on the western side of the Forum building in the south western corner. The photo (**Figure 18**) appears to have been taken from the balcony on the southern side of the unit. It is clear from this image that the important city skyline, Harbour Bridge and Harbour views around those iconic features will not be obstructed and view sharing principles are satisfied..

Figure 18 Forum (East) Unit 1701 - Panorama

Unit 2002 is located on the western side of the Forum building and is a west facing apartment. The balustrade on the left hand side of the photo (**Figure 19**) indicates that the photo was probably taken leaning over the balustrade and is thus not a fair representation of the view from the balcony (if sitting) or living areas. In any event the photo shows that the height of the proposed building affects part of the panorama, but not iconic city views and the harbour/river views are still available and view sharing principles are satisfied.

Figure 19 Forum (East) Unit 2002 - Panorama

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Unit 2901 is located on the western side of the Forum building in the south western corner. It is not certain where the photographer was standing when taking the photo (**Figure 20**). The photomontage illustrates that the proposed building would impact on views over part of the Wollstonecraft peninsula across Parramatta River to Balmain. Iconic views to the city skyline, Harbour Bridge and the Harbour setting are unaffected and view sharing principles are satisfied.

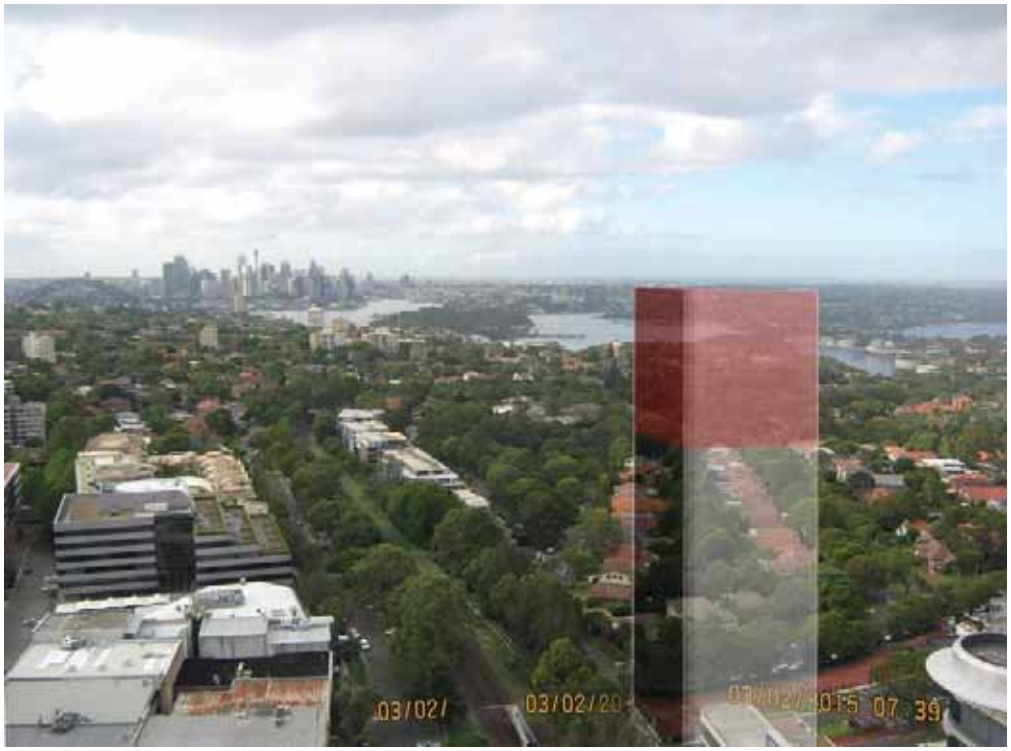

Figure 20 Forum (East) Unit 2901

Unit 1801 is located in the south-western corner of Forum West. The balustrade and blade wall on the left hand side of the photo (**Figure 21**) suggest that this photo was taken from the west facing balcony adjoining the second and third bedrooms. This photo illustrates that upper parts of some of the buildings in the western city skyline are blocked by the upper part of the building. Sydney Tower and the Harbour Bridge remain within view. This view however is not the primary aspect from these bedrooms which is more southwest over the office building in the foreground and the wide panorama of Parramatta and Lane Cove Rivers is unaffected. This apartment also has a balcony and main living areas further to the east which will lessen this view impact as the view changes reference point.

Figure 21 Forum West Unit 1801

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Unit 2401 is located in the south-western corner and is a 2 storey apartment. The main living areas appear to be on level 24 and presumably bedrooms are located on Level 25. **Figure 22** shows that the proposed building affects views over Berry's Island and Darling Harbour. The iconic views for the Harbour Bridge, city skyline, Sydney Tower, Anzac Bridge would be unaffected. The panorama over the Parramatta and Lane Cove Rivers is also unaffected. The view sharing principles are also satisfied.

Figure 22 Forum West Unit 2401

Figures 23 and 24 are an analysis of the view cones from the Forum East and Forum West apartment buildings.

From Forum East, the views are predominantly to the south-east. **Figure 23** illustrates that the proposed high rise building will not affect the iconic views to the CBD, Sydney Harbour Bridge and Anzac Bridge. The affected view is over Wollstonecraft, Berry Island peninsula across Parramatta river and part of Balmain. This represents only a very small portion of the available views.

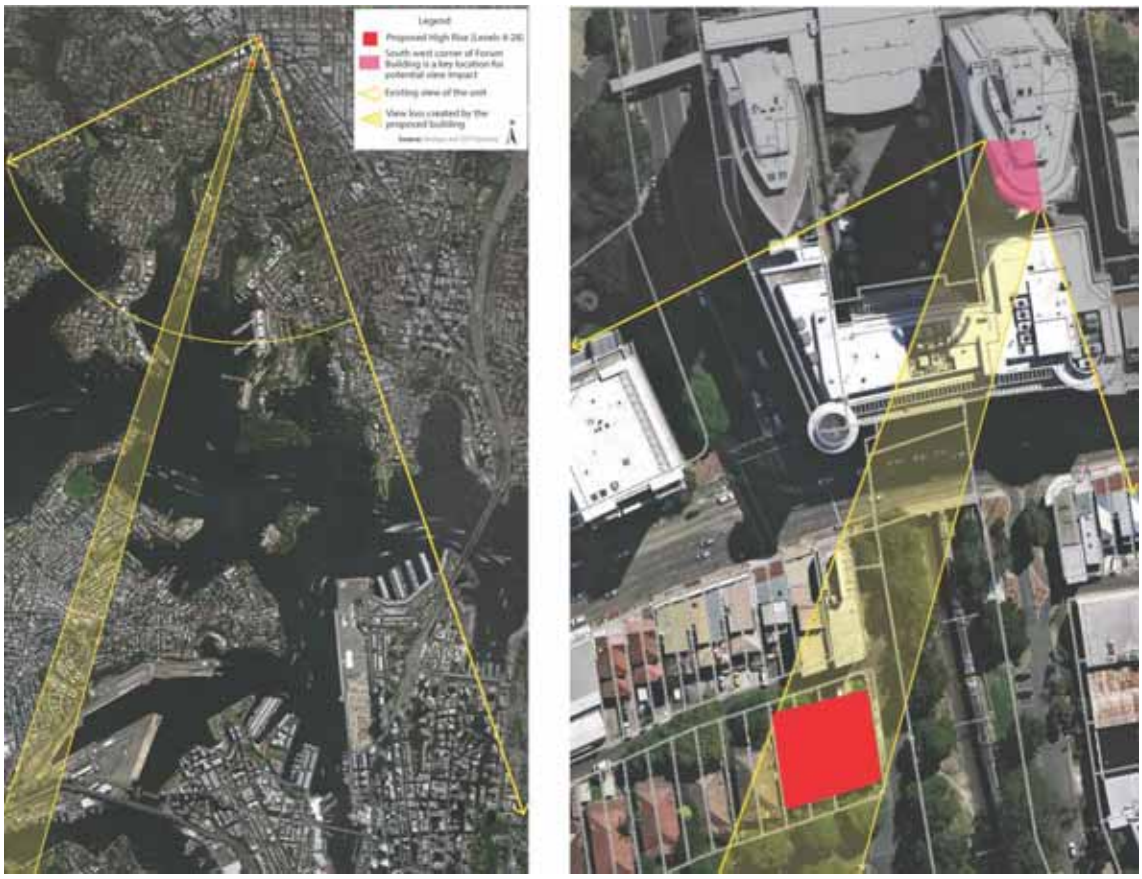

Figure 23 Viewing angles from Forum East

From Forum West, the commercial component of the Forum development obstructs views from the lower levels. The upper levels (estimated to be from level 14) have west facing balconies and windows, but views are available towards the south. **Figure 24** illustrates the very large angle of views from the apartments. The proposed high rise building would only obstruct a very minor component of the available view. It would affect part of the view of the view down the Balls Head peninsula and Darling Harbour. However significant views of the Parramatta River west of the proposed high rise building will be unaffected. The Forum West also enjoys views down the length of the railway corridor to the CBD and harbour bridge. Their view corridor aligns with the railway corridor and the roads either side and therefore those iconic views will remain unaffected. The impact is considered to be reasonable and when balanced against the objectives of focussing residential development at major transport and employment hubs is an acceptable and balanced outcome.

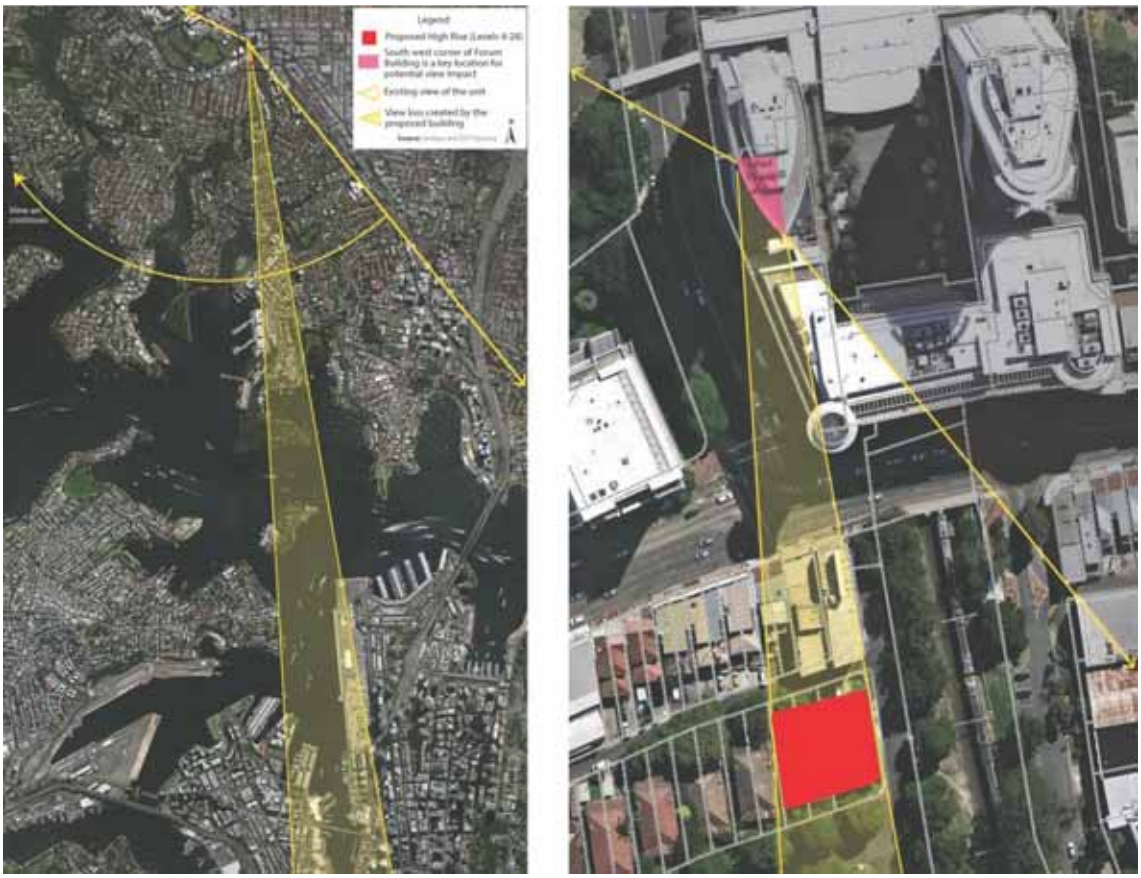

Figure 24 Viewing angles from Forum West

Abode apartments

The Abode apartments are located to the east of the Site on the corner of the Pacific Highway and Albany Street. Part of the development has views to the southwest and west towards the subject site. Lower level apartments would already have views obstructed by buildings fronting the Pacific Highway. A high rise building on the Site would be visible from the upper levels of the Abode building, however, the extent of visual impact is minor. A high rise building on the Site would not affect any views that might be enjoyed to the south west across the Greenwich Peninsula, Lane Cove River and Hunters Hill Peninsula.

However, the above assessment needs to be considered in the context of the future buildings that are likely to be constructed to take advantage of the recent amendment to Lane Cove LEP 2009 that increased the building height at 500-504 Pacific Highway (Charter Hall site) to 37 storeys and 472-494 Pacific Highway (Leighton site) to 24-34 storeys. It is highly likely that

buildings of this height will take place given the very recent amendment of Lane Cove LEP (May 2015) in respect of these properties.

In addition, the Planning Proposal that has received Gateway determination for 84-90 Christie Street and 75-79 Lithgow Street (Winten site) that proposes a base height of 20-37 storeys and a public benefit scheme of 27-44 storeys. The views from Abode apartments have been represented in **Figure 25** and have indicated where the future buildings are located.

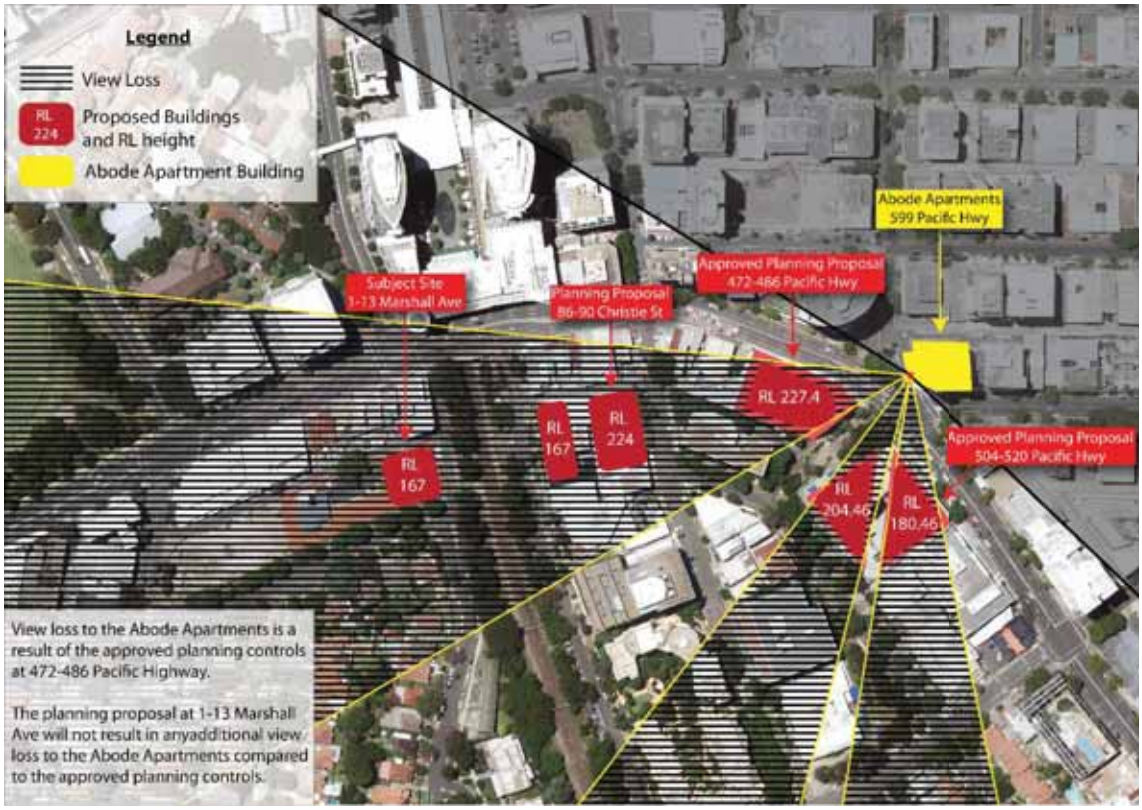

Figure 25 View cone from Abode Apartments

Figure 25 clearly illustrates that the height of the Charter Hall and Leighton sites (on the Pacific Highway) will obstruct views from the Abode Apartments and the high rise building proposed for 1-13 Marshall Avenue will sit behind those towers and not contribute to view loss. The same condition applies to the Winten site in Lithgow Street. In the unlikely event that the Pacific Highway buildings are not constructed or if the Planning Proposal for the Lithgow/Christie Street does not proceed, then the proposed 94m tower will be visible from the Abode apartments but will only affect part of the views available from the apartments within the building and the distance separation will maintain a significant proportion of the currently available views.

Commercial development on Northern Side of Pacific Highway

The commercial development on the northern side of the Pacific Highway would gain views across the site towards the south-east to south-west. These buildings have a height of varying from 4 to 13 storeys. Lane Cove LEP 2009 permits a building height of 36m in the B3 Commercial Core zoned land on the southern side of the Pacific Highway between Canberra Avenue and Berry Road. A building height of 36m equates to approximately 10 commercial levels. The existing height controls under the relatively recent Lane Cove LEP 2009 would therefore obstruct potential views from these commercial buildings. If the views from the existing commercial buildings are to be protected, then this would be at the expense of achieving the objectives of the B3 zone to provide for retail, business, office space and employment opportunities close to transport.

Despite the above, the height of the high rise building above 65m (level 19/20) would not affect the views from the commercial buildings which are lower than the levels above 65m.

Commercial development on Southern Side of Pacific Highway

Future development on the northern side of Marshall Lane (Pacific Highway properties) will experience a view impact which is inevitable if this land is developed in accordance with the planning controls applying to the site. The Pacific Highway properties have a maximum building height of 36m. Because the proposed low rise building is below the 25m building height control applying to the subject site, future buildings on the Pacific Highway properties will be able to capture views from their upper levels across this building. Those buildings in the immediate vicinity of the proposed high rise building will have views obstructed which has been considered in the previous Planning Proposal that increased building height to 65m and the current Planning Proposal relating to a building height increasing from 65m to 94m. The building on the corner of Canberra Avenue (2-4 Pacific Highway) will still capture views from part of the floor space down the combined Canberra Avenue/railway corridor towards the city skyline.

5.2.6 Acoustic and Vibration Impact Upon the Proposed Dwellings

Renzo Tonin & Associates has prepared an Acoustic Assessment which is attached at **Appendix 12** and has considered potential acoustic and vibration issues including:

- Traffic noise from the Pacific Highway (as per the Infrastructure SEPP);
- Local traffic noise from Marshall Avenue;
- Rail noise and vibration from the North Shore Railway Line (as per the Infrastructure SEPP); and
- Mechanical plant located on the subject building.

Traffic and Rail Noise

In terms of traffic and rail noise, Renzo Tonin & Associates has referenced the Infrastructure SEPP and "*Development Near Rail Corridors and Busy Roads, Interim Guideline, 2008"* to establish the relevant interior noise criteria for the future apartments.

Renzo Tonin note that due to traffic and rail noise, the internal criteria cannot be achieved with windows and doors opened on the facades of the buildings. In such circumstances, the Guidelines provide that if interior noise levels with windows and doors open exceed the criteria by more than 10dBA, then ventilation must comply with the BCA. In this case, air-conditioning is proposed for all apartments which will provide the necessary ventilation.

Glazing treatments are recommended by Renzo Tonin. The lower levels require a lower level of treatment, and the upper levels that are not shielded by other buildings will require a high level of treatment.

Rail Vibration

Renzo Tonin has referred to the "*Development Near Rail Corridors & Busy Roads – Interim Guideline*", which references a number of documents that can be used to establish train vibration criteria for residential buildings. Renzo Tonin has used *Assessing Vibration: A technical guideline (EPA 2006)* as the appropriate standard.

Train vibration levels have been measured by Renzo Tonin to establish the Vibration Dose Value at 1 Marshall Avenue, being the worst affected boundary of the development. The measurements were taken on a weekday afternoon when trains operate frequently. They have established that the Vibration Dose Value at the boundary is well below both the day time and night time criteria of the above technical guide and therefore no vibration treatment is necessary.

Mechanical Plant

Mechanical plant has not been selected and therefore cannot be tested against the Industrial Noise Policy (INP). Renzo Tonin has provided a range of suggested acoustic treatments that could be utilised to ameliorate noise impacts to the adjacent residential properties.

5.2.7 Acoustic and Vibration Impact Upon Surrounding Properties

Renzo Tonin has prepared a Construction Noise and Vibration Management Plan (**Appendix 13**) to assess construction and vibration impacts during the course of construction and recommend mitigation measures. Their assessment has considered impacts on the nearby residential properties to the south, commercial development on the northern side of Marshall Lane and on the eastern side of the railway line.

The *NSW Interim Construction Noise Guide* (ICNG), 2009 has been determined to be the appropriate assessment guideline and is referenced in their assessment. As with any construction site there will be noise impacts. Renzo Tonin has recommended a number of noise management measures that can be implemented depending on their appropriateness at different stages of the construction. They have also recommended implementation of a complaints management procedure.

Renzo Tonin has referenced the EPA's *Assessing Vibration: a technical guideline* (DECC, 2006) has the relevant assessment guideline. Renzo Tonin has recommended a number of vibration management measures that can be implemented and complaints management procedure. In addition, they also recommend the preparation of dilapidation reports to document the state of existing buildings within the vicinity of the construction zone.

An appropriate condition could be imposed on the development consent to require the implementation of the noise and vibration management measures documented in their report, the implementation of a complaints management procedure and preparation of dilapidation reports.

5.2.8 Street Tree Impacts

The site has been cleared of buildings and trees under separate development consent. The street trees in Marshall Avenue have been assessed in terms of impacts arising from the proposed development.

There are 8 street trees, seven of which are *Lophostomen confertus* (Brush Box) and one is a *Casuarina cunninghamia* (River She Oak). Aboreport has prepared an Aboricultural Impact Assessment which is attached at **Appendix 17**. Aboreport has assessed the significance of the trees. Six of the Brush Box trees have been determined to have high significance, and one Brush Box and the casuarina are assessed as having moderate significance.

The Casuarina (Tree 33) is proposed to be removed to accommodate the vehicular access to the basement. The Casuarina is a different species to the avenue of Brush Box trees which dominate Marshall Avenue. Aboreport notes that "*while this tree is suitable for retention it should not be considered a constraint to the proposed development.*"

Aboreport has also considered the potential impact of the basement excavation on the roots of the Brush Box trees. The basement has been sited 3m off the Marshall Avenue boundary to reduce the extent of works necessary in the tree protection zone. The potential impact to the root zone was also apparent for the approved Stage 1 development, for which the excavation of the basement has been completed, and in this regard Aboreport notes as follows:

> *"The existing retaining walls have been built directly onto sandstone bedrock and are expected to form a continuous barrier to root growth. This was anticipated to be the case for Stage One for all six street trees located on the Marshall Ave road reserve and subsequently confirmed on site. Therefore, it is anticipated there will be marginal root loss only from this activity, provided the base course of masonry/sandstone walls and soil at that level are demolished carefully by hand. If major roots are found, an AQF Level 5 arborist should be contacted and their opinion sought for consideration of the use of*

alternative construction measures such as bridged footings for the proposed masonry walls to protect roots."

Arboreport also anticipates that piling rigs and scaffolding will require pruning of the Brush Box trees on their northern parts of their crowns to provide 1.5m clearance, and in this regard concludes that "*the amount of crown removal will be sustainable by the trees if a minimum qualified AQF Level 3 Arborist carries out the work in a manner which retains as much of the crown as possible and is consistent with AS 4373 (2007) The Pruning of Amenity Trees."*

Recommendations are also made in relation to any services work in the road reserve that might impact on tree roots.

The Arborist Report sets out a number of recommendations to manage the above potential impacts as well as setting out tree protection measures that will need to be implemented during construction.

5.2.9 Stormwater and Drainage

Wood and Grieve Engineers has prepared hydraulic services layout plans that are attached at **Appendix 8**.

The system includes a 110,000 litre on-site detention tank through which most of the water collected from the building and site will be directed before being discharged to the Council's stormwater system. This will assist with water quality and water volumes being discharged from the site. The stormwater will be discharged to a new stormwater main in Marshall Lane. The new main is a diversion of the current stormwater pipe that passes through 5A and 7 Marshall Avenue from Marshall Lane to Marshall Avenue. There is no easement reflecting the location of this existing stormwater pipe and it cannot be retained due to the basement construction. The diversion of the stormwater pipe is being managed via a separate application process with Council.

The proposed development also makes provisions for an overland flow path through the common open space area.

Wood and Grieve Engineers has also prepared a sediment and erosion control plan which is also attached at **Appendix 8**.

5.2.10 Traffic Impacts

The proposal separates the basement car park access (located on Marshall Avenue) from the two loading and servicing areas (located on Marshall Lane).

A total of 291 car parking spaces have been provided which complies with the ADG.

A dedicated truck lay back shared zone designed for garbage collection vehicles and furniture removal has been provided off Marshall Lane. The layback is 3m wide to ensure service vehicles do not obstruct the traffic on Marshall Lane.

Traffic Generation and Impacts

Traffix Traffic and Transport Planners has prepared a Traffic Impact Assessment a copy of which is attached at **Appendix 14**. Their assessment has considered the impacts of the traffic generation on the surrounding streets and intersections.

Traffix notes that the RMS *Technical Direction TDT 2013/04a* recommends applying a trip generation rate of 0.14 trips/dwelling (AM) and 0.07 trips/dwelling (PM) for high density residential flat development in St Leonards. However, Traffix has applied the Sydney Average rate for high density residential development which is a higher and more conservative rate of 0.19 (AM) and 0.15 (PM) trips/dwelling. A rate of 0.4 trips/ parking space has been used for the commercial component of the development.

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SIDRA Modelling was carried out to examine the impacts on two nearby intersections including:

- Pacific Highway and Berry Road; and
- River Road and Duntroon Avenue.

In conducting the modelling there has been no reduction in traffic generation to take into account the 14 dwellings that previously occupied 1-13A Marshall Avenue however traffic likely to be generated by the Stage 1 development has been factored in. The traffic generation from the proposed development (residential and commercial) is 52 vehicles per hour in the AM peak and 41 vehicles per hour PM peak.

Based on the SIDRA modelling, Traffix has concluded that "*the development will have minimal impact on the performance of the surrounding road network with all surrounding intersections continuing to operate with acceptable Level of Service and moderate delays. The net additional traffic represents less than one vehicle every minute, which is split into arrivals and departures as well as being distributed onto all available access routes."*

The intersection of Berry Road and the Pacific Highway has also been investigated and the traffic impact assessment has found that alterations to the intersection are not required and that the traffic impacts have been found to be acceptable.

Site Access

A roundabout has been proposed at the intersection of Marshall Avenue and Holdsworth Avenue and the vehicular access into the site will form a fourth leg to the existing 'T' intersection. The roundabout solution has been proposed as without the roundabout, the vehicle access point would technically be designated as a 'prohibited location'.

The roundabout has been sized based on the roundabout geometry provided at the nearby Marshall Avenue / Berry Road intersection. The plans indicate that a similar roundabout can be provided within the road reserve currently available (i.e. there is no intrusion in to the subject site or properties adjoining the intersection).

A swept path analysis has been carried out by Traffix to demonstrate that the roundabout can cater for vehicles up to the 99 percentile.

A swept path analysis of the loading bays off Marshall Lane has also been undertaken, including the turning areas at the intersections of Marshall Lane/Canberra Avenue and Canberra Avenue/Marshall Avenue. These demonstrate that a 10m rigid truck can manoeuvre into and out of the bays and within the existing road reserves.

Car Parking

Clause 30 of SEPP 65 provides that car parking cannot be used for a ground for refusal if the car parking provided is equal to or greater than Part 3J of the ADG. The proposal has been designed to meet the minimum ADG requirement as set out in the **Table 5** below.

Table 4 Car Parking provision as per Part 3J of ADG

Land Use	Rate	No of Dwellings	Required	Provided
Studio	0.6 spaces/dwelling	21	13	
1 Bedroom Apartment	0.6 spaces/dwelling	98	59	
2 Bedroom Apartment	0.9 spaces/dwelling	113	102	
3 Bedroom Apartment	1.4 spaces/dwelling	37	52	
Sub Total			**226**	**234**

Table 4 Car Parking provision as per Part 3J of ADG				
Visitor	1 space/5 dwellings	269	54	54
Commercial (as per DCP)	1 space/110m^2	286m^2	3	3
TOTAL			**283**	**291**

A total of 291 car parking spaces are provided which complies with the ADG.

Traffix has reviewed the car park design against AS 2890.1 (2004) including ramp gradients, manoeuvring areas, head heights and dead-end aisles. Traffix has determined that the access and internal design is generally compliant with AS2890.1. The disabled car parking spaces also comply with AS2890.6 with a clear 2.4m width adjacent to a minimum shared area of 2.4m.

54 visitor car parking spaces have been provided in accordance with the ADG. However, the DCP requires 1 disabled car parking space for every 10 visitor car parking spaces provided for sites near St Leonards railway station. Therefore of the 54 visitor car parking spaces, the DCP requires a total of 6 to be disabled visitor car parking spaces. The development provides 2 disabled visitor car parking spaces.

By way of comparison the DCP has a much lower rate of 1 disabled visitor car parking space per 50 visitor spaces for sites not near St Leonards station (refer to Table 1 of Part R of the DCP). If that rate was applied to the proposed development, then 2 disabled visitor car parking spaces would be required. The rationale behind a higher rate of disabled car parking spaces close to St Leonards railway station is not explained in the DCP. Section 2.3 of Part R of the DCP states that on-site parking rates shall be reduced for land within 400m of St Leonards railway station, therefore increasing the rate of disabled visitor car parking spaces from 1 disabled car parking space /50 visitor spaces to 1/10 spaces is contrary to the objectives of the DCP.

One reason for the difference in car parking rates could be the availability of on-street car parking spaces close to St Leonards railway station. However, the availability of on-street car parking in other areas of Lane Cove LGA (e.g. around Lane Cove town centre) is comparable to St Leonards, but a higher rate does not apply.

By way of comparison, Part F of the DCP requires 1 space/100 car parking spaces and the proposal complies with this requirement. In light of the above comments, we consider that the 1/10 rate is a typographical error and should have read 1/100, which would align with Part F of the DCP and be consistent with the Council's objective of reducing car parking close to the train station.

Construction Traffic Management Plan

A CTMP can be submitted prior to issue of a construction certificate, consistent with the approach for the approved Stage 1 DA. The truck routes for the excavation and construction phases will be the same as those nominated in the approved CTMP for Stage 1.

5.2.11 Solar Reflectivity

Windtech has undertaken a Solar Light Reflectivity Analysis which is attached at **Appendix 16**. Windtech has considered viewing points from locations close to the site and further afield and considers drivers, train drivers, pedestrians and occupants of nearby buildings.

Windtech's assessment has determined that in order "*to avoid adverse glare to drivers and pedestrians on the surrounding streets, train drivers, occupants of neighbouring buildings, and to comply with the abovementioned planning control requirements, the following recommendations should be incorporated:*

- *The glazing selected for the balustrades on the southern aspect of the low-rise component of the development should have a maximum normal specular reflectance of visible light of 8%.*
- *All other glazing used on the external façade of the development should have a maximum normal specular reflectance of visible light of 20%."*

A development consent can incorporate a condition to reflect this recommendation.

5.2.12 Wind Environment Study

Cermak Peterka Petersen (CPP) has prepared wind test report, a copy of which is attached at **Appendix 15**. Their assessment included creating a model of the development and surrounding areas and topography to a radius of 430m from the site. Measurements of winds likely to be experienced by pedestrians were made at 34 locations for 16 wind directions each. Tests were conducted in two configurations in order to discern the impact of the proposed building on the wind conditions along nearby streets, the main podium, and private balconies.

The results of the wind testing have informed the design and subject to some design recommendations for the communal open space and Marshall Lane, CPP concluded as follows:

> *"The proposed Embassy Tower development is expected to have an impact on the local wind amenity particularly along Canberra Avenue and Marshall Lane. In general, the impact of the entire development is expected to produce windier conditions than existing, but will be similar to wind conditions in other areas of St. Leonards. Mitigation in the form of porous vertical barriers, such as trees along Marshall Lane has been shown to improve wind conditions in the public space to an acceptable level."*

5.2.13 Waste Management

A Waste Management Plan has been prepared by Elephants Foot Recycling Solutions which is attached at **Appendix 18**. This also contains a waste management plan in respect of the ongoing use of the building prepared by Elephants Foot Recycling Solutions. Part Q of the DCP relating to Waste Management has been address in the DCP assessment tables at **Appendix 7**.

5.2.14 Public Benefits

Public Plaza

The VPA will provide Council with significant funds to contribute to the delivery of the St Leonards Bus Rail Interchange and plaza. This plaza and interchange is seen by Council as a key public domain project for St Leonards south, and the VPA will contribute significantly to the total cost of work identified in the works schedule of the Contributions Plan.

Footpath to Marshall Lane

The proposal also provides a footpath along the length of Marshall Lane. This is a continuation of the footpath from the Stage 1 DA. The footpath is being provided within the subject site.

The footpath is 3m in width consistent with the DCP. It is noted that the 3m wide footpath is very generous (compared to a standard footpath of between 1.2m to 2m wide depending on pedestrian volumes). In sections, the path is a shared zone to provide the service bays. A roll kerb is provided to each service bay (in the same alignment as the standard kerb and gutter profile used elsewhere). This allows the finished level and material of the service bay to match the remainder of the footpath. The bays will be visually distinguished with bollards allowing pedestrians to use the full footpath width when the service bays are not in use. This same shared zone occurs for the approved Stage 1 building.

The pedestrian volumes along Marshall Lane are not expected to be high, as most pedestrian traffic will come to/from the train station along Canberra Avenue and/or Marshall Avenue. The width of the path is therefore considered appropriate.

The footpath is proposed to be constructed of concrete for consistency with the approved pavement treatment for Stage 1. The use of concrete is appropriate as it is a low maintenance material and consistent with other footpaths in the immediate area, including Marshall Avenue, Canberra Avenue and Berry Road.

5.2.15 Crime Prevention Through Environmental Design

As assessment against the principles of *Crime Prevention Through Environmental Design* (CPTED) is provided below.

Surveillance

The retail and commercial tenancy facing Canberra Avenue combined with the pedestrian entrances to each building apartment will create an active pedestrian environment providing good surveillance to both streets. Service access corridors that exit on to Marshall Lane from each building will also generate pedestrian movements in the lane (particularly for residents walking to the Pacific Highway) to activate these spaces. CCTV surveillance is proposed along Marshall Lane and to the pedestrian entrance off Marshall Lane.

The buildings' interfaces with the footpaths are clear of obvious entrapment areas.

The building contains balconies and habitable rooms to both the Marshall Avenue, Canberra Avenue and Marshall Lane frontages which will provide casual surveillance to those streets.

Access Control

The basement car parking area will be provided with a security roller shutter with an intercom system to ensure access is available to visitors. Secure parking is considered necessary to avoid the basement car parking area (particularly visitor car parking spaces) from being used by local workers or commuters. Access to the building will be controlled through the use of an intercom at the main entrance into each building.

Territorial Reinforcement

The boundary wall along Marshall Avenue and the separate entrance gates to the townhouses will define the site boundaries. A new footpath along Marshall Lane will reinforce the 'edge' of the site, and the service areas will also assist in defining spaces.

The base of the high rise building is built to the street boundary along Canberra Avenue which will define the public/private interface and provide the commercial tenancy with good pedestrian access and exposure for future tenants.

Space Management

As with developments of this scale, maintenance staff would be employed by the owners' cooperation to manage the common facilities, waste storage facilities, landscaped areas as well as general upkeep and maintenance of the buildings.

5.3 Suitability of the Site for Development

The following subsections assess the suitability of the Site in accordance with Section 79C(1)(c) of the EP&A Act.

5.3.1 Strategic Planning

The suitability of the site has been largely determined in the strategic planning for the Lane Cove LGA which informed the Lane Cove LEP 2009. In particular this stemmed from:

- The Metropolitan Plan for Sydney 2036;

- The draft Inner North Subregion Strategy, 2007; and
- The St Leonards Strategy, November 2006.

As discussed below, these strategic planning documents have determined the suitability of the site for mixed use development and more intensive forms of residential development.

A Plan for Growing Sydney and draft Inner North Subregion Strategy

In 2014, the Department of Planning and Environment released *A Plan for a Growing Sydney.* This Plan replaced the Metropolitan Plan for Sydney. The Plan contains:

A vision for Sydney: A strong global city, a great place to live. The vision is supported by four goals.

Four goals for Sydney:

Goal 1: A competitive economy with world-class services and transport

Goal 2: A city of housing choice with homes that meet our needs and lifestyles

Goal 3: A great place to live with communities that are strong, healthy and well connected

Goal 4: A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

Three planning principles that will guide how Sydney grows:

Principle 1: Increasing housing choice around all centres through urban renewal in established areas

Principle 2: Stronger economic development in strategic centres and transport gateways

Principle 3: Connecting centres with a networked transport system

One of the key components of *A Plan for a Growing Sydney* is to accelerate the delivery of new housing in Sydney to meet the needs of a bigger population and to satisfy a growing demand for different types of housing. *Over the next 20 years, the population in Sydney will grow much faster than in the last 20 years. Projections indicate that Sydney will need around 664,000 additional homes over the next 20 years. New housing will be needed in greenfield locations and the established urban area. Providing housing in a variety of sizes, types and locations will be essential to meeting Sydney's future housing need. Increasing housing supply will boost economic activity and generate viable infrastructure and business investment opportunities.*

The proposed development will provide a dwelling density in a location well serviced by public transport and other services and facilities which is consistent with the objectives of *A Plan for a Growing Sydney.*

North Subregion

The LGAs of Lane Cove Willoughby and North Sydney are all located within the North Subregion. St Leonards extends across all three LGAs. St Leonards is identified as a Strategic Centre in *A Plan for a Growing Sydney* and the priorities for St Leonards are:

- Work with Council to retain a commercial core in St Leonards for long-term employment growth.
- Work with Council to provide capacity for additional mixed-use development in St Leonards including offices, health, retail, services and housing.
- Support health-related land uses and infrastructure around Royal North Shore Hospital.
- Work with Council to investigate potential future employment and housing opportunities associated with a Sydney Rapid Transit train station at St Leonards/Crows Nest.

5 Environmental Planning Assessment

The proposal will contribute towards the housing targets for the North Subregion in a location close to employment in and around the St Leonards train station.

Draft Inner North Subregion Strategy, 2007

The draft Inner North Subregion Strategy, 2007 identifies targets for the Lane Cove local government area (LGA), but because St Leonards is located within three LGAs, there are more specific objectives established for St Leonards as a strategic centre.

The draft Strategy identifies St Leonards as a Specialised Centre within the North Sydney to Macquarie Park Economic Corridor. An employment target of an additional 8,200 jobs is set for St Leonards which would be distributed over all three LGAs and primarily in the core Business General area (less so in transitional areas such as the subject site). A housing target of an additional 3,900 dwellings has been set for the Lane Cove LGA and the draft Strategy identifies the provision of mixed-use development in St Leonards as a means for increasing residential densities.

The proposed development can make a significant contribution to achieving the objectives and actions of the draft Inner North Subregion Strategy and Metropolitan Plan in particular by assisting in achieving the following key objectives:

- Locate at least 80% of new housing within walking catchments of centres with access to public transport;
- Provide a mix of housing;
- Provide more jobs in centres, more houses in centres and more houses near jobs; and
- Target development around transport.

The DA can realise the site's opportunity to provide increased housing near established transport nodes whilst improving built form outcomes. The DA is considered to be consistent with the draft Strategy.

The Council's resolution to commence a masterplan process for the St Leonards South precinct is also a response to achieving the targets of the Metropolitan Plan.

The St Leonards Strategy

The St Leonards Strategy, November 2006 covers the Lane Cove, Willoughby and North Sydney LGAs for the St Leonards Specialised Centre as identified in the Metropolitan Plan for Sydney 2036. The St Leonards Strategy has four main purposes:

- To inform the content of a new LEP, as part of the NSW Planning Reform Program;
- To identify how the economic role of the centre can be strengthened;
- To identify how sustainability, amenity and a sense of place in the centre can be strengthened; and
- To establish a coordinated planning approach from the three councils.

The outcomes of this Strategy informed the preparation of the Lane Cove LEP 2009. The St Leonards Strategy identified specific recommendations for precincts, including the Western Precinct which includes the Marshall Avenue land. The Strategy recommended the relaxation of land use prohibitions to allow mixed use between Marshall Avenue and the Pacific Highway. This recommendation has been implemented through the application of the B4 – Mixed Use zone over the subject site. The reason for this recommendation was "*to promote the redevelopment of underdeveloped sites."* The proposal is consistent with the outcome for the site.

5.3.2 Location and access to public transport and services

As explained above, the suitability of the site for residential development has already been established through the strategic planning both at a regional and local level which identified this site for higher density development.

Specifically the site is well serviced by public transport including trains at St Leonards Station and buses along Pacific Highway. These transport options are within walking distance of the subject site.

The site is located close to major employment (e.g. St Leonards commercial area and North Shore Public and Private hospitals in the immediate vicinity) and other employment centres accessible by public transport.

5.3.3 Contamination

The subject site was previously residential and had been residential since at least the early 1900s. The former dwelling houses having been demolished under a separate development consent.

In accordance with SEPP 55, Environmental Investigation Services (EIS) has prepared a Preliminary Stage 2 Environmental Site Assessment for the property. A copy of their report is attached at **Appendix 9**. Their assessment takes into account the findings documented in other Stage 1 and Stage 2 Environmental Site Assessment reports prepared by EIS for the adjoining site at 15-25 Marshall Avenue.

Because a Stage 1 Environmental Site Assessment has already been carried out for the wider property of 1-25 Marshall Avenue, the attached Stage 2 Environmental Site Assessment only relates to the subject site. The potential contaminants had only marginally elevated levels and because the land is being excavated, and the soil will be removed, they pose a low risk to human health and groundwater. EIS made the following conclusions in relation to contamination:

- The potential for significant, widespread soil or groundwater contamination at the site is considered to be relatively low.
- The soil and groundwater contamination conditions at the site are considered to pose a relatively low risk to the human and environmental receptors.
- Having regard to the above two findings EIS concluded that remediation of the site (and preparation of a RAP) is not required.
- The site is considered to be suitable for the proposed residential development.

EIS also noted that "*in the event of an unexpected find during earthworks, EIS should be contacted immediately. This should facilitate appropriate adjustment of the works programme and schedule in relation to the changed site conditions*."

During construction works, the excavated material will be classified in accordance with the NSW DECCW Waste Classification Guidelines, and disposed of at a licensed landfill facility. A condition can be imposed on a development consent to this effect.

5.3.4 Geotechnical considerations

Geotechnical (General)

JK Geotechnics has prepared a Geotechnical Investigation report which is attached at **Appendix 11**. The purpose of the investigation was to obtain geotechnical information on subsurface conditions as a basis for comments and recommendations on excavation, retention and footings.

JK Geotechnics has made recommendations in relation to excavation methodology where they note that conventional earth moving equipment is likely to suffice for the upper strata, but higher strength rock will require rock excavation equipment such as such as hydraulic rock hammers, ripping hooks, rotary grinder, or rock saws.

The assessment has recommended the use of vibration monitors and alternative excavation methods if vibrations exceed certain limits specified in the Vibration Emission Design Goals.

As noted in Section **Error! Reference source not found.** – Acoustic Impacts to Surorunding Properties, Renzo Tonin recommended the implementation of the noise and vibration management measures documented in their report and the implementation of a complaints management procedure and preparation of dilapidation reports in light of the likely excavation methods required for the development. These can be imposed as conditions of development consent with relevant reports to be submitted prior to commencement of works.

Geotechnical (Rail Corridor)

Parsons Brinckerhoff has prepared a *Geotechnical assessment of impact of proposed residential development on Sydney Trains infrastructure* a copy of which is attached at **Appendix 10**. The report assesses the impact of the proposed excavation and buildings on the adjoining railway corridor including:

- The existing railway corridor comprising two tracks;
- The planned quadruplication of the existing tracks; and
- The planned CBD Rail Link (Harbour Rail Link) project which contemplates two bored tunnels within the railway corridor.

Their report also addresses the deferred commencement conditions of the previous (refused) DA. Parsons Brinckerhoff has referred to

- the geotechnical investigations carried out by JK Geotechnics in 2011 and the findings of their Geotechnical Investigations report of 2014 attached as **Appendix 10** to this SEE; and
- BG&E Structural Drawings attached as part of the package of information at **Appendix 10**; and
- Pile Design Solutions report on the soldier pile shoring wall attached as part of the package of information at **Appendix 10.**

Parsons Brinckerhoff has also had reference to other geotechnical explorations on the site and other locations to understand the underlying geology likely to be encountered during excavation and assess potential impacts on the future CBD Rail Link tunnels. They expect that medium to high strength rock will be encountered between RL 65 and the planned CBD Rail Tunnel invert of RL 54.

Parsons Brinckerhoff has considered a number of geotechnical and structural impacts relative to the existing and planned railway infrastructure including:

- stress redistribution effects around the proposed deep basement and impacts on the proposed running tunnel;
- stress relief effects due to basement excavation on existing *Sydney Trains* infrastructure point loads from ground anchors and other support;
- ground movement effects;
- construction impacts including vibration and staging; and
- changes to the groundwater regime.

In relation to the above matters (and based on the structural drawing and pile design) Parsons Brinckerhoff has concluded that "*basement excavation at 1-13A Marshall Avenue, St Leonards can be expected to result in minor changes to existing ground stress, groundwater regime and deformation in the ground within the Sydney Trains corridor. These effects are negligible and are not expected to impact the existing Sydney Trains infrastructure and the future construction of the proposed CBDRL and the quadruplication project in St Leonards."*

In terms of construction impacts, Parsons Brinkerhoff expect that basement excavation methods will be limited by local restrictions on ground vibration and noise and therefore impact hammering or saw-cutting methods will likely be employed. They advise that these methods are not expected to adversely impact ground conditions in the rock.

They recommend further assessment of expected peak ground acceleration induced by excavation and also recommend vibration monitoring to confirm negligible impact to Sydney Trains infrastructure due to basement excavation work. These can be imposed as conditions of consent.

In terms of changes to the groundwater regime, Parsons Brinkerhoff note that local groundwater levels around the proposed development appear to be below excavation depth. They expect that the groundwater variation within the Sydney Trains corridor would be minimal.

The combination of the Parsons Brinckerhoff, the JK Geotechnics assessments, BG&E structural drawings and piles design has addressed the range of matters for consideration in the *Development Near Rail Corridors and Busy Roads: Interim Guideline.*

In view of the above, it is considered that the site is suitable for the proposed development.

5.4 Submissions

The proposed development is required to be publicly notified in accordance with Lane Cove DCP. Pursuant to section 79(1)(d) of the EP&A Act, Council will be required to give due consideration to any submissions made during that notification period.

5.5 Public Interest

This SEE has addressed the potential impacts of the proposal in relation to the adjoining land uses and surrounding area and has found the level of impact to be acceptable.

Traffic impacts have been found to be acceptable and will not adversely affect the level of service at the signalised intersection of Berry Road and Pacific Highway ensuring the wider community is not adversely affected by the proposed development.

The established treed character of Marshall Avenue will be retained and the street trees protected as set out in the Arborist Report.

The VPA will also provide funds (in addition to Section 94 contributions) that can be directed towards the financing of the public plaza adjacent to the subject site and extending across Canberra Avenue, over the railway line to tie in with Lithgow Street. This project, which is already identified in the Council's Development Contributions Plan, will deliver a significant public benefit to both the local residential and the St Leonards working communities.

More broadly, the proposal is considered to be in the wider public interest by providing additional housing in a location with excellent access to public transport, services, facilities, retail and employment. This is consistent with the both State, Regional and Local strategies.

5 Environmental Planning Assessment

5.6 Other Relevant Legislation

A Building Code of Australia Compliance report has been prepared by McKenzie Group, and a copy of their report is attached at **Appendix 20**. The report demonstrates that the building is capable of achieving the deemed to satisfy provisions of the BCA, but will also include fire engineered solutions.

The Access Report attached at **Appendix 19** has also reviewed the proposal against the Disability and Discrimination Act, 1992 and Council's DCP.

6 Conclusion

The proposed development for the construction of a mixed use development at 1-13 Marshall Avenue, St Leonards has been assessed against the relevant legislation, planning instruments and DCPs.

The SEE demonstrates that the proposal is acceptable in terms of potential impacts such as built form and existing character, desired future character having regard to recent strategic planning decisions and the emerging scale of buildings in the locality, traffic impacts, solar access, privacy and stormwater and drainage.

The proposed height complies with the 94 metre eight of building development standard once Lane Cove LEP is amended.

Residential amenity of the proposed dwellings has also been found to be acceptable in the SEPP 65 assessment and accompanying review against the Apartment Design Guide. There are some minor variations which are considered reasonable and acceptable.

The site is well located being close to public transport, employment and services and facilities available in the immediate area.

Accordingly, the proposal is considered to satisfactorily respond to the opportunities and constraints of the site and the relevant legislation, is unlikely to result in adverse impacts in the locality and is worthy of approval following the amendment of Lane Cove LEP in relation to the 94 metre building height control.

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

1-13A MARSHALL AVENUE, ST LEONARDS

Construction Noise and Vibration Management Plan

20 June 2014

Loftex

TG788-01F03 (r0) CNVMP

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Document details

Detail	Reference
Doc reference:	TG788-01F03 (r0) CNVMP
Prepared for:	Loftex
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Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
20.06.2014		-	0	MCH	MCH	MCH

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1 Introduction

Renzo Tonin & Associates were engaged by Loftex to prepare a Construction Noise and Vibration Management Plan (CNVMP) for the construction works for the proposed residential development located at 1-13A Marshall Avenue, St Leonards suitable for submission to Council with the Development Application. More specifically, this management plan will provide guidelines to reduce noise and vibration impacts to nearby affected receivers during the construction works.

This report summarises the results of attended noise monitoring previously undertaken to determine existing background and ambient noise levels.

In accordance with relevant guidelines, the following methodology was used for the assessment of construction noise and vibration for the proposed development during construction works.

- Identify potential sources of noise and vibration during the proposed works;
- Specify noise and vibration criteria for the proposed works;
- Where applicable, provide feasible and reasonable mitigation measures which could be implemented to reduce noise and vibration levels; and
- Present procedures to handle complaints.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 Project description

2.1 Background information

The proposal is for the construction of a residential development located at 1-13A Marshall Avenue, St Leonards. The assessment presented in this management plan is for the construction stage of the project, which involves excavation and construction phases. Demolition of the existing buildings on site is covered under a separate Development Application and has not been addressed in this assessment.

A noise and vibration management plan is required for the excavation and construction phases of the proposal. Construction noise and vibration impacts are to be assessed in accordance with the requirements of the NSW Environment Protection Authority's (EPA) 'Interim Construction Noise Guideline' (ICNG).

2.2 Receiver locations

The nearest affected receivers were identified during a site inspection and details are as follows:

- Receiver R1 – 6 Marshall Avenue
  Residential property located approximately 25m south of the development site, across Marshall Avenue. This receiver is representative of the nearest affected residences along Marshall Avenue

- Receiver R2 – Commercial/ retail premises on Pacific Highway
  Retail and commercial premises along the Pacific Highway, approximately 10m north of the development site, across Marshall Lane. This receiver is representative of the nearest affected commercial and retail premises across Marshall Lane.

- Receiver R3 – Commercial premises on Lithgow Street
  Commercial premises along Lithgow Street, approximately 75m east of the development site and across the North Shore railway line. This receiver is representative of the nearest affected commercial premises along Lithgow Street.

The assessment locations are identified as Receivers R1, R2 and R3 in Appendix B.

2.3 Proposed equipment

Noisy plant and equipment likely to be used during the construction works are provided in Table 2.1 below.

Table 2.1 – Proposed construction plant and equipment

Plant Item	Plant Description
Excavation	
1	Rock Breaker/ Hammer
2	Excavator
3	Dump Trucks
Construction	
4	Mobile Crane
5	Dump Trucks
6	Concrete Trucks
7	Power Generator

2.4 Construction hours

Lane Cove Council stipulates construction hours to be limited to 7.00am to 5.30pm Monday to Friday and 7.00am to 4.00pm Saturdays with no work on Sundays or Public Holidays. There is no proposal for night time construction works.

3 Existing acoustic environment

Noise impact at the receiver locations is assessed against noise goals established from the existing noise environment of the area without the subject premise in operation. Appendix B of the NSW Environment Protection Authority's (EPA) 'Industrial Noise Policy' (INP) presents two methods of determining the background noise levels of an area being 'B1 – Long-term background noise method' and 'B2 – Short-term background noise method'. For the subject assessment, long-term noise monitoring was undertaken to establish the existing acoustic environment.

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NSW INP requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The INP defines these periods as follows:

- Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

3.1 Long-term unattended noise monitoring

Long-term unattended noise monitoring was previously undertaken at the following location between Tuesday 5th April and Tuesday 12th April 2011. It is noted that this noise monitoring was undertaken as part of the construction noise and vibration management plan prepared for the adjacent site at 15-25 Marshall Avenue, St Leonards.

- Location M1 – 13A Marshall Ave, St Leonards
  Noise monitor located in the rear yard of the property backing onto Marshall Lane. Noise environment representative of Receivers R1, R2 and R3.

Existing background and ambient noise levels are presented in Table 3.1 below.

Table 3.1 – Measured existing background (L_{90}) & ambient (L_{eq}) noise levels, dB(A)

Location	L_{90} Background Noise Levels			L_{eq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Location M1 – 13A Marshall Ave	46	44	40	52	51	45

Notes:
1. Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Given that the proposed construction hours are during the day period, only the day period will be assessed for from herein.

4 Construction noise

4.1 Construction noise criteria

The NSW 'Interim Construction Noise Guideline' (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- *Use of LAeq as the descriptor for measuring and assessing construction noise*

  NSW noise policies, including the INP, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- *Application of reasonable and feasible noise mitigation measures*

  As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

  Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Given the scale of the construction works proposed for the residential development, a quantitative assessment is carried out herein, consistent with the ICNG's requirements.

4.1.1 Residences

Table 4.1 below sets out the noise management levels and how they are to be applied for residential type receivers. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 4.1 – Noise at residences using quantitative assessment

Time of Day	Management Level $L_{Aeq\ (15\ min)}$*	How to Apply
Recommended standard hours: Monday to Friday 7 am to 5:30 pm Saturday 7 am to 4 pm (as per Lane Cove Council's Construction Hours) No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Residential receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified in Table 4.1 above. The noise affected level represents the point above which there may be some community reaction to noise. Where predicted and/or measured construction noise levels exceed the noise management levels, all feasible and reasonable work practices should be applied to meet the management levels.

During standard construction hours a highly affected noise objective of $L_{Aeq(15min)}$ 75dB(A) applies at all residential receivers.

In addition to the objectives identified in Table 4.1, where construction activities are tonal or impulsive in nature and are described in the ICNG as being particularly annoying, 5dB(A) must be added to the activity noise. Activities that are defined in the ICNG as particularly annoying (relevant to construction compounds) include the use of 'beeper' style reversing or movement alarms.

4.1.2 Commercial premises

Commercial premises are located near the proposed development site and in accordance with Section 4.1.3 of the ICNG, commercial properties should be assessed for construction noise impacts. The noise management levels presented in the ICNG for commercial premises are reproduced in Table 4.2 below.

Table 4.2 – Noise at commercial premises using quantitative assessment

Type of Premises	Management level, $L_{Aeq\ (15\ min)}$
Commercial (such as offices and retail outlets)	External noise level = 70 dB(A)

4.1.3 Summary of management levels

The background noise levels previously measured at the monitoring location were considered to be representative of the RBL for residences potentially affected by the construction works at 1-13A Marshall Avenue, St Leonards. Therefore, measured background noise levels are suitable for setting construction noise criteria, consistent with a conservative assessment.

Based on the above management levels applicable for the type of receivers surrounding the site, a summary of the management levels for each receiver location are presented in the table below.

Table 4.3 – Summary of construction noise management levels

Receiver	Time of Day	Base Management Level $L_{Aeq(15min)}$
Receiver R1 – 6 Marshall Ave	During recommended standard hours (day)	46 + 10 = 56dB(A)
Receiver R2 – Commercial Premises (Pacific Hwy)		70dB(A)
Receiver R3 – Commercial Premises (Lithgow St)		

4.2 Construction noise sources

The following table lists the proposed construction plant and equipment likely to be used by the contractor to carry out the necessary construction works for this project as specified in Section 2.3.

Table 4.4 – Typical construction plant & equipment and sound power levels, dB(A) re 1pW

Plant Description	L_{Aeq} Sound Power Levels
Rock Breaker/ Hammer	117
Mobile Crane	110
Excavator	107
Concrete Trucks	106
Dump Trucks	105
Power Generator	100

The sound power levels for the majority of activities presented in the above table are based on maximum levels given in Table D2 of Australian Standard 2436 - 2010 "Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites", information from past projects and information held in our library files.

4.3 Predicted construction noise levels

Noise levels at any receptors resulting from construction would depend on the location of the receptor with respect to the area of construction, shielding from intervening topography and structures and the

type and duration of operation being undertaken. Furthermore, noise levels at receivers will vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Based on the typical construction plant and equipment presented in Table 4.4, the noise levels likely to be experienced by the nearest affected receivers are presented in Table 4.5 below.

Table 4.5 – Predicted L_{eq} noise level ranges at receiver locations, dB(A)

Plant Item	Plant Description	Predicted L_{Aeq} Construction Noise Levels		
		Receiver R1	Receiver R2	Receiver R3
Criteria		*56*	*70*	*70*
Excavation				
1	Rock Breaker	81	89	72
2	Excavator	71	79	62
3	Dump Truck	69	77	59
All plant operating concurrently		82	90	72
Construction				
4	Mobile Crane	74	82	64
5	Dump Truck	69	77	59
6	Concrete Truck	70	78	61
7	Power Generator	64	72	55
All plant operating concurrently		76	84	67

Based on the construction noise levels predicted above, the construction noise criteria will generally be exceeded at the nearest sensitive receivers when all equipment are operating concurrently. However, compliance is predicted at Receiver R3 when the construction phase of the works is to be undertaken.

Furthermore, at the residential receiver (R1) noise impacts from the construction plant and equipment are predicted to result in the receiver being ‘highly noise affected’ [ie. > 75dB(A)].

Therefore, a reasonable and feasible approach towards noise mitigation measures, including the implementation of respite periods for highly noise affected residences, will be required to reduce noise levels as much as possible to manage the impact from construction noise.

4.4 Noise mitigation measures

4.4.1 General engineering noise controls

Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 “Guide to Noise Control on Construction, Demolition and Maintenance Sites”, are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after

treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 4.6 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 4.6 – Relative effectiveness of various forms of noise control, dB(A)

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	5 to 10	5 to 10	20	20
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	5 to 10	5 to 10	15	15
Engine Silencing	Residential class mufflers	15 to 25	10 to 20	50	30
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this assessment.

Furthermore, Table 4.7 below identifies possible noise control measures, which are applicable on the construction plant likely to be used on site.

Table 4.7 – Noise control measures for likely construction plant

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Rock Breaker / Hammer	✔	✖	✔	✔
Mobile Crane	✔	✖	✔	✖
Excavator	✔	✖	✔	✖
Concrete Truck	✔	✖	✔	✖
Dump Trucks	✔	✖	✔	✖
Power Generator	✔	✔	✔	✖

4.4.2 Construction noise management measures

The following recommendations provide in-principle feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers. Where actual construction activities differ from those

assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

In addition to physical noise controls, the following general noise management measures should be followed:

- Where solid boundary fences are to erected for the operational phase of the development, these should be installed early in the construction phase so that residents benefit from noise shielding.
- Use less noisy plant and equipment, where feasible and reasonable.
- Plant and equipment should be properly maintained.
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods during construction work should be switched off.

In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. See Appendix G for an example of a complaint handling procedure and form.

Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided or result in residences being highly noise affected, then consideration may be given to implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. That is, daily periods of respite from noisy activities may be scheduled for building occupants during business hours.

Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable and to be negotiated with the residents. For example, between 10am and 3pm (with one-hour break for lunch between 12pm and 1pm), noisy activities could occur with no noise level restrictions over a limited time period. Residents would be notified of the potential noise impact during this time period so that they can organise their day around the noisy period. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.

5 Construction vibration

5.1 Vibration objectives

Construction vibration from the proposed development is associated with the following types of impact:

- disturbance to building occupants;
- potential damage to buildings; and

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The SI unit for distance is the meter (m), although common industrial standards include mm.
- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is meters per second (m/s), although common industrial standards (including the TfNSW vibration limits) include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.
- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is meters per second squared (m/s2).Construction vibration goals are summarised below.

Construction vibration goals are summarised below.

5.1.1 Disturbance to building occupants

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's 'Assessing Vibration; a technical guideline' (DECC, 2006). The guideline provides criteria which are based on the British Standard BS 6472-1992 'Evaluation of human exposure to vibration in buildings (1-80Hz)'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 5.1 provides definitions and examples of each type of vibration.

Vibration sources are defined as Continuous, Impulsive or Intermittent. Table 5.1 provides a definition and examples of each type of vibration.

Table 5.1 – Types of vibration

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

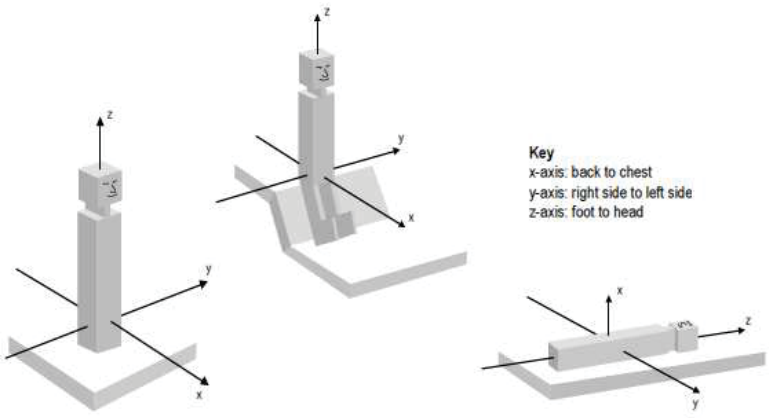
Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 1. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 1 – Orthogonal axes for human exposure to vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 5.2 for residential and commercial / retail type receivers.

Table 5.2 – Preferred and maximum levels for human comfort

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Intermittent vibration (Vibration Dose Values, VDV, $m/s^{1.75}$, 1-80Hz)					
Residences	Daytime	0.20		0.40	
	Night-time	0.13		0.26	
Offices, schools, educational institutions and places of worship	Day- or night-time	0.40		0.80	

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

5.1.2 Damage to buildings

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 and German Standard DIN4150-3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

Within DIN4150-3, damage is defined as "*any permanent effect of vibration that reduces the serviceability of a structure or one of its components"* (p.2). The Standard also outlines:

> *"that for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if*
>
> - *cracks form in plastered surfaces of walls;*
> - *existing cracks in the building are enlarged;*
> - *partitions become detached from loadbearing walls or floors.*
>
> *These effects are deemed 'minor damage. " (DIN4150.3, 1990, p.3)*

The differences in levels of damage are more defined in British Standard 7385 Part 1 1990 (p.10):

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

The vibration limits in Table 1 of British Standard 7385 Part 2 (1993) are also for the protection against cosmetic damage. Guidance on limits for minor or major damage is provided in Section 7.4.2 of the Standard (p.5):

> *"7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values."*

5.1.2.1 British Standard

British Standard 7385: Part 2 'Evaluation and measurement of vibration in buildings', can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

The cosmetic damage levels set by BS 7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Damage comprises minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4Hz to 250Hz, being the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The values set in the Standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and

may need to be reduced by up to 50%. Table 5.3 sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 5.3 – BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity[1], mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	Cosmetic	50		
		Minor	100		
		Major	200		
2	Un-reinforced or light framed structures. Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor	30 to 40	40 to 100	100
		Major	60 to 80	80 to 200	200

Notes: 1. Peak Component Particle Velocity is the maximum peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

5.1.2.2 German Standard

German Standard DIN 4150 - Part 3 '*Structural vibration in buildings - Effects on Structure*' (DIN 4150-3), also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative.

DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure. The vibration limits increase as the frequency content of the vibration increases. The criteria applicable to residential and commercial / retail type receivers are presented in Table 5.4.

Table 5.4 – DIN 4150-3 structural damage criteria

Group	Type of structure	Vibration velocity, mm/s			
		At foundation at frequency of			Plane of floor uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15

5.2 Construction vibration sources

Typical vibration levels from construction equipment most likely to cause significant vibration are summarised below. The information was sourced from a variety of reference materials available in the Renzo Tonin & Associates library.

Table 5.5 – Typical ground vibration generated by construction plant

<table>
<tr><th>Activity</th><th>Typical ground vibration</th></tr>
<tr><td>Rock Breaker / Hammer</td><td>The table below sets out typical ground vibration levels at various distances from rock-breakers operating in hard sandstone. Use of smaller machines can reduce levels of vibration significantly. Vibration associated with even large road-headers is significantly lower than from rock-breakers, due to the nature of the operation (grinding versus impulsive breaking of the rock)
<table>
<tr><th rowspan="2">Operation</th><th colspan="6">Vibration level (mm/s) at given distance</th></tr>
<tr><th>5m</th><th>10m</th><th>20m</th><th>30m</th><th>40m</th><th>50m</th></tr>
<tr><td>Heavy rock-hammer</td><td>4.5</td><td>1.3</td><td>0.4</td><td>0.2</td><td>0.15</td><td>0.1</td></tr>
<tr><td>Light rock-hammer</td><td>1</td><td>0.3</td><td>0.1</td><td>0.05</td><td>0.01</td><td>-</td></tr>
</table></td></tr>
<tr><td>Excavators</td><td>Typical ground vibration from excavators range from 1mm/s to 2mm/s at distances of approximately 5m and at distances greater than 20m, vibration levels are usually below 0.2mm/s.</td></tr>
<tr><td>Truck traffic</td><td>Typical vibration from heavy trucks passing over normal (smooth) road surfaces generate relatively low vibration levels in the range of 0.01 - 0.2mm/s at the footings of buildings located 10 - 20m from a roadway. Very large surface irregularities can cause levels up to five to ten times higher.

In general, ground vibration from trucks is usually imperceptible in nearby buildings. The rattling of windows and other loose fittings that is sometimes reported is more likely to be caused by airborne acoustic excitation from very low frequency (infrasonic) noise radiated by truck exhausts and truck bodies. While this may cause concern to the occupants, the phenomenon is no different from the rattling caused by wind or people walking or jumping on the floor and fears of structural damage or even accelerated ageing are usually unfounded.</td></tr>
</table>

5.3 Buffer distances for vibration control

The relationship between vibration and the probability of causing human annoyance or damage to structures is complex. This complexity is mostly due to the magnitude of the vibration source, the particular ground conditions between the source and receiver, the foundation-to-footing interaction and the large range of structures that exist in terms of design (eg dimensions, materials, type and quality of construction and footing conditions). The intensity, duration, frequency content and number of occurrences of vibration, are all important aspects in both the annoyances caused and the strains induced in structures.

The pattern of vibration radiation is very different to the pattern of airborne noise radiation, and is very site specific. Accordingly, indicative minimum ‘buffer’ distances, applicable to this proposal, have been developed for various plant types (based on recent example projects) to avoid structural damage and human discomfort to residential receivers during daytime hours as shown by Table 5.6 below.

Table 5.6 – Recommended minimum buffer distances for construction plant

Construction Equipment	Recommended Buffer Distance	
	Structural Damage	Human Response
Small Rock Breaker / Hammer 300kg (5-12 tonne excavator)	2m	7m
Medium Rock Breaker / Hammer 900kg (12-18 tonne excavator)	7m	23m
Excavators	10m	15m
Truck movements	<5m	10m

Based on the above table and the nearest residential receiver (R1) being approximately 25m from the subject site, vibration levels from the construction plant and equipment are likely to comply with the set limits when vibration generating activities occur near the boundary of the construction site.

Nevertheless, in order to determine safe working distances to avoid structural damage and human discomfort, site specific buffer distances should be determined through vibration testing of actual equipment on site prior to their commencement of site operation. It should be noted that the buffer distances identified above are a guide only.

5.4 Vibration management measures

The proper implementation of a construction noise and vibration management plan is required to avoid adverse vibration disturbance to affected occupancies. Consultation with stakeholders is recommended and should be aimed at providing a communication path directly to the contractor.

All stakeholders within the vicinity of the proposed construction works should be notified prior to the commencement of substantial construction where vibration may be perceptible during construction activities.

A management procedure will be implemented to deal with vibration complaints. Each complaint will be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures shall be put in place to mitigate future occurrences. An example of a vibration complaint management procedure and complaint form is presented in Appendix G of this report.

The following feasible and reasonable in-principle vibration control measures are provided to minimise vibration impact from construction activities to the nominated receivers:

- Carry out vibration testing of actual equipment on site to determine acceptable site-specific buffer distances to sensitive occupancies.
- Carry out additional vibration monitoring as specified in Appendix F when construction activities are at the nearest point to the nominated occupancies and within the buffer distances determined. This monitoring may signal to the contractor by way of a buzzer or flashing light etc, when levels approach / exceed the recommended limits in nearby occupancies.
- Carry out periodic monitoring at all critical or sensitive areas when complaints arise, and the vibration levels are to be tested for compliance with the set vibration limits. This monitoring should be undertaken in accordance with the noise and vibration monitoring program described in a construction noise and vibration management plan described in Appendix F.
- Where vibration is found to be excessive and exceed the applicable limits, management measures may be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods, alternative construction equipment and/or procedures, establishment of safe buffer zones and if necessary, time

restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

- We recommend the preparation of dilapidation reports on the state of the existing buildings within the vicinity of the construction zone.

6 Complaints management

Noise and vibration levels generated by the construction works for the proposed residential development located at 1-13A Marshall Avenue, St Leonards, should aim to comply with the noise and vibration goals set by the relevant regulations and guidelines.

The construction contractor is responsible for implementing this Construction Noise and Vibration Management Plan and ensuring that all reasonable measures are implemented such as the provision of a Noise / Vibration Complaints Program, to minimise the generation of excessive noise and vibration levels from the site to nearby sensitive areas.

Owners and occupants of nearby affected properties shall be informed by direct mail of a direct 24-hour telephone line where any noise and / or vibration complaints related to the operation of the construction activities will be recorded. Additionally, owners and occupants will be notified of any periods of noisy construction activities at least 24 hours prior to their commencement.

All noise and vibration complaints shall be investigated by the site in accordance with the Noise / Vibration Complaint Management Procedure identified in Appendix G of this report.

7 Conclusion

A Construction Noise and Vibration Management Plan (CNVMP) has been prepared for the proposed residential development at 1-13A Marshall Avenue, St Leonards. Specifically, this plan aims to manage noise and vibration impacts during the construction of the residential development through noise and vibration management measures, to achieve compliance with relevant guidelines and standards.

Reasonable and feasible mitigation measures are provided to limit the potential impact of noise and vibration generated by construction activities to acceptable levels. In addition, buffer distances for vibration compliance have been provided as guidance; however, should be determined in more detail prior to the start of construction works through on-site measurements of vibration.

Procedures to manage complaints are also provided in Section 6 and Appendix G to ensure complaints are dealt with accordingly.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dBThe sound of a rock band 115dBLimit of sound permitted in industry 120dBDeafening
dB(A)	A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the “A” filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Site and receiver locations

Figure 2 – Site, surrounds and receiver locations

APPENDIX C Noise monitoring methodology

C.1 Noise monitoring equipment

Long term noise monitoring was conducted using a RTA Technology 01 noise logger. The noise monitoring equipment used here complies with AS IEC 61672.1 2004 “Electroacoustics - Sound Level Meters” and is designated as a Type 1 instrument suitable for field use.

A noise monitor consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory. The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

C.2 Meteorology during monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the INP. The Bureau of Meteorology (BOM) provided meteorological data, which is considered representative of the site, for the duration of the noise monitoring period. The data was modified to allow for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is at 1.5m above ground level. The correction factor applied to the data was taken from *Australian Standard AS1170.2 1989 Section 4.2.5.1*.

C.3 Noise vs time graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the $\mathbf{L_{10}}$, $\mathbf{L_{90}}$, and $\mathbf{L_{eq}}$ levels. The statistical descriptors $\mathbf{L_{10}}$ and $\mathbf{L_{90}}$ measure the noise level exceeded for 10% and 90% of the sample measurement time. The $\mathbf{L_{eq}}$ level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes.

Noise levels are commonly measured in units of A-weighted decibels or dB(A). The "A-weighting" refers to a standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low pitch sound than it is to high pitch sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample time period. This is represented as the $\mathbf{L_{90}}$ noise level.

APPENDIX D Specification for determining the sound power levels of construction plant

D.1 Scope

This document specifies methods for determination of sound power levels for construction plant including earthmoving equipment and other ancillary plant and equipment used during construction.

D.2 Referenced standards

- Australian Standard 1259 – 1990: “Acoustics - Sound Level Meters”
- Australian Standard 2012.1-1990: “Acoustics - Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors - stationary test condition - Part 1: Determination of compliance with limits for exterior noise”
- ISO 6395: “Acoustics & Measurement of airborne noise emitted by earthmoving machinery - Dynamic test conditions”
- AS1217.5-1985: “Acoustics – Determination of sound power levels of noise sources – Part 5 – Engineering methods for free-field conditions over a reflecting plane”
- AS1217.7-1985: “Acoustics – Determination of sound power levels of noise sources – Part 5 – Survey method”

D.3 Testing procedures – earthmoving machinery

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

Each significant plant item shall be tested in terms of both the ‘stationary’ and the ‘dynamic’ testing procedures detailed below.

All sound level meters used must be Type 1 instruments as described in Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters” and calibrated to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics). The calibration of the meters shall be checked in the field before and after the noise measurement period.

D.3.1 Stationary testing

Stationary measurements shall be performed on all earthmoving plant according to the method of AS2012.1-1990.

In addition to measuring overall A-weighted noise levels, octave band frequency LAeq,T noise levels shall also be measured at each measurement location from 63Hz to 8kHz inclusive. Background noise

shall also be recorded in the same octave band frequency range, and corrections to measured octave-band noise levels shall be applied as described in Table 1 of AS2012.1-1990.

Each plant item should be tested in isolation, without any other noisy plant on site operating. Where this cannot be done for practical reasons, then the noise of the plant being tested shall be at least 5dB greater than the background noise from other nearby plant, both in terms of the overall A-weighted level and in all octave band frequencies.

Measured octave-band LAeq,T noise levels shall also be processed as described in Section 8 of that Standard to establish octave-band sound power levels.

The overall A-weighted sound power levels to be determined shall be in terms of both the LAeq,T and LA10,T noise metrics. The measurement sample time shall be selected so that it is representative of the operating cycle/s of the plant being tested.

Where the plant tested or noise measurements are taken within 3.5 metres of large walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

All measured noise level data and determined sound power levels shall be included in the test reports.

D.3.2 Dynamic testing

Details of equipment operation during testing will vary depending on the equipment type. Dynamic measurements shall be performed on all earthmoving plant according to the method in International Standard ISO 6395.

In addition to measuring overall A-weighted noise levels, octave band frequency LAeq,T noise levels shall also be measured at each measurement location from 63Hz to 8kHz inclusive. Background noise shall also be recorded in the same octave band frequency range, and corrections to measured octave-band noise levels shall be applied as described in International Standard ISO 6395.

Each plant item should be tested in isolation, without any other noisy plant on site operating. Where this cannot be done for practical reasons, then the noise of the plant being tested shall be at least 5dB greater than the background noise from other nearby plant, both in terms of the overall A-weighted level and in all octave band frequencies.

Measured octave-band LAeq,T noise levels shall also be processed to establish octave-band sound power levels.

Where the plant tested or noise measurements are taken within 3.5 metres of large walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

The overall A-weighted sound power levels to be determined shall be in terms of both the LAeq,T and LA10,T noise metrics. The measurement sample time shall be selected so that it is representative of the operating cycle/s of the plant being tested.

All measured noise level data and determined sound power levels shall be included in the test reports.

D.4 Testing procedures – other construction plant

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

All sound level meters used must be Type 1 instruments as described in Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters”. The calibration of the meters shall be checked in the field before and after the noise measurement period.

Noise measurements shall be performed on all non-earthmoving construction plant according to the methods of either AS1217.5-1985 or AS1217.7-1985, whichever is applicable to the items of plant being tested. Machinery shall be operated at high idle speed.

In addition to measuring overall A-weighted noise levels, octave band frequency LAeq,T noise levels shall also be measured at each measurement location from 63Hz to 8kHz inclusive. Background noise shall also be recorded in the same octave band frequency range, and corrections to measured octave-band noise levels shall be applied as described in Table 1 of AS2012.1-1990.

Each plant item should be tested in isolation, without any other noisy plant on site operating. Where this cannot be done for practical reasons, then the noise of the plant being tested shall be at least 5dB greater than the background noise from other nearby plant, both in terms of the overall A-weighted level and in all octave band frequencies.

Measured octave-band LAeq,T noise levels shall also be processed as described in Section 8 of that Standard to establish octave-band sound power levels.

The overall A-weighted sound power levels to be determined shall be in terms of both the LAeq,T and LA10,T noise metrics. The measurement sample time shall be selected so that it is representative of the operating cycle/s of the plant being tested.

Where the plant tested or noise measurements are taken within 3.5 metres of large walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

All measured noise level data and determined sound power levels shall be included in the test reports.

APPENDIX E Specification for contruction noise monitoring

E.1 Scope

This document specifies methods for undertaking noise monitoring during the construction phase of the project.

E.2 Referenced standards & guidelines

- Australian Standard 1259–1990: “Acoustics - Sound Level Meters”
- Australian Standard 1055-1989 “Acoustics - Description and Measurement of Environmental Noise”
- NSW Environment Protection Authority’s “Environmental Noise Control Manual”
- NSW Environment Protection Authority’s “Industrial Noise Policy”

E.3 Testing procedures

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

All noise monitoring equipment used must be at least Type 2 instruments as described in Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters” and calibrated to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics). The calibration of the monitoring equipment shall also be checked in the field before and after the noise measurement period, and in the case of long-term noise monitoring, calibration levels shall be checked at minimum weekly intervals.

Long-term noise monitoring equipment or Noise Loggers, consist of sound level meters and computers housed in weather resistant enclosures. The operator may either retrieve the data at the conclusion of each monitoring period either in person or via a telephone modem if the logger is fitted with a mobile phone option. The nominated long-term environmental noise level monitors are to be of the RTA Technology Pty Ltd [phone (02) 8218 0570] type or equivalent.

All environmental noise measurements shall be taken with the following meter settings:

- Time Constant – FAST (ie 125 milliseconds)
- Frequency Weightings – A-weighting
- Sample Period – 15 minutes

All outdoor noise measurements shall be undertaken with a windscreen over the microphone. Windscreens reduce wind noise at the microphones.

Measurements of noise should be disregarded when it is raining and the wind speed is greater than 5 m/s (18 km/hr).

E.3.1 Long-term (unattended) monitoring

Noise monitoring shall be undertaken in accordance with the environmental noise measurement requirements stipulated in the reference standards and documents listed above.

Noise monitoring equipment shall be placed at positions which have unobstructed views of general site activities, whilst shielded as much as possible from non-construction site noise (eg. road traffic, rail noise and other surrounding noise).

Noise levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in memory for later retrieval is the following A-weighted noise levels: Lmin, L90, Leq, L10, L1 and Lmax.

Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Meteorological conditions such as wind velocity, wind direction and rainfall shall also be either monitored on site or recorded from the nearest weather station to the project site, over the entire noise monitoring period.

E.3.2 Short-term (attended) monitoring

Attended short-term noise monitoring shall be conducted at noise receiver locations with closest proximity to the construction activities.

Short-term noise monitoring shall be conducted within the first month of commencement of construction works, and then every 1 to 2 months thereafter, dependent on the level of complaint from construction activities.

All attended short-term noise monitoring shall be recorded over 15 minute sample intervals. Noise levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in memory and reported are the following A-weighted noise levels: Lmin, L90, Leq, L10, L1 and Lmax.

Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Outdoor noise monitoring is to be undertaken with the microphone at a height of 1.2 – 1.5m from the ground, unless noise measurements are taken from a balcony or verandah, in which case the same microphone height shall apply off the floor.

Conditions such as wind velocity, wind direction, temperature, relative humidity and cloud cover shall also be recorded during short-term noise monitoring.

Noise monitoring shall be undertaken in accordance with the environmental noise measurement requirements stipulated in the reference standards and documents listed above.

The following information shall be recorded:

- Date and time of measurements
- Type and model number of instrumentation
- Results of field calibration checks before and after measurements
- Description of the time aspects of each measurement (ie sample times, measurement time intervals and time of day)
- Sketch map of area
- Measurement location details and number of measurements at each location
- Weather conditions during measurements
- Operation and load conditions of the noise sources under investigation
- Any adjustment made for presence or absence of nearby reflecting surfaces
- Noise due to other sources (eg traffic, aircraft, trains, dogs barking, insects etc)

APPENDIX F Specification for construction vibration monitoring

F.1 Scope

This document specifies methods for undertaking vibration monitoring during the construction phase of the project.

F.2 Referenced standards & guidelines

- AS 2775: “Mechanical Mounting of Accelerometers”
- AS 2670.2: “Part 2: Evaluation of human exposure to whole body vibration”
- EPA ENCM: “Chapter 174 – Vibration in Buildings”
- DIN 4150.3: “Structural Vibration in Buildings – Effects on Structures”
- BS 7385:1: “Evaluation and Measurement for Vibration in Buildings – Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings”
- BS 7385:2: “Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration”
- ISO 4866: “Mechanical Vibration & Shock – Vibration of Buildings – Guidelines for the Management of the Vibrations and Evaluation of their Effects on Buildings”

F.3 Testing procedures

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking vibration measurements.

All vibration monitoring equipment used must be calibrated at least once every two years to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics). The monitoring system should also have a measurement frequency range down to 1Hz.

Long-term vibration monitoring equipment or Vibration Loggers consist of a computer unit connected by cable to a triaxial vibration transducer which senses vertical, axial and horizontal vibration. Vibration levels are continuously monitored, and the data is processed statistically and stored in the computer memory. The operator may either retrieve the data at the conclusion of each monitoring period either in person or via a telephone modem if the logger is fitted with a mobile phone option. The nominated long-term Vibration Loggers are to be of the RTA Technology Pty Ltd [phone (02) 8218 0570] type or equivalent.

F.3.1 Long-term (unattended) monitoring

Vibration monitoring shall be undertaken at vibration sensitive locations determined to fall within the 'buffer distances' established for each item of plant during the commencement of use of each plant on site.

Vibration monitoring shall be undertaken continuously whilst the vibrating plant is operational within the pre-determined 'buffer distances' from the potentially affected building.

Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest, closest to the vibrating plant.

Vibration levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of vibration metrics to be stored in memory for later retrieval is the following:

- Vector-sum root-mean-square (rms) – maximums and statistical metrics
- Vector-sum peak-particle velocity (ppv) – maximums and statistical metrics

Vibration monitoring shall be undertaken in accordance with the vibration measurement requirements stipulated in the reference standards and documents listed above. The following notes of importance are included here:

- Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest, closest to the vibrating plant
- The surface should be solid and rigid in order to best represent the vibration levels entering the structure of the building under investigation
- The vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces
- The vibration sensor or transducer shall be directly mounted to the vibrating surface using bees wax or a magnetic mounting plate onto a steel plate or bracket either fastened or glued to the surface of interest
- Where a suitable mounting surface is unavailable, then a metal stake of at least 300mm in length shall be driven into solid ground adjacent to the building of interest and the vibration sensor or transducer shall be mounted on that

F.3.2 Short-term (attended) monitoring

Where vibration complaints or requests from relevant authorities are received, attended short-term vibration monitoring shall also be conducted at the requested location and at any other relevant vibration receiver location with closest proximity to the construction activities.

Short-term vibration monitoring shall be used to supplement long-term vibration monitoring undertaken at nearby locations, and to check whether or not the vibration levels measured by the long-term vibration monitors are caused by construction activities carried out on site.

All attended short-term vibration monitoring shall be recorded over 15 minute sample intervals. Vibration levels are to be recorded at a minimum rate of 10 samples per second. The minimum range of vibration metrics to be stored in memory and reported are the following:

- Root-mean-square (rms) – maximums and statistical levels
- Peak-particle velocity (ppv) – maximums and statistical levels

In addition to measuring and reporting overall vibration levels, statistical vibration levels shall also be measured and reported in third-octave band frequencies from 1Hz to 250Hz.

Vibration monitoring shall be undertaken in accordance with the vibration measurement requirements stipulated in the reference standards and documents listed above. The following notes of importance are included here:

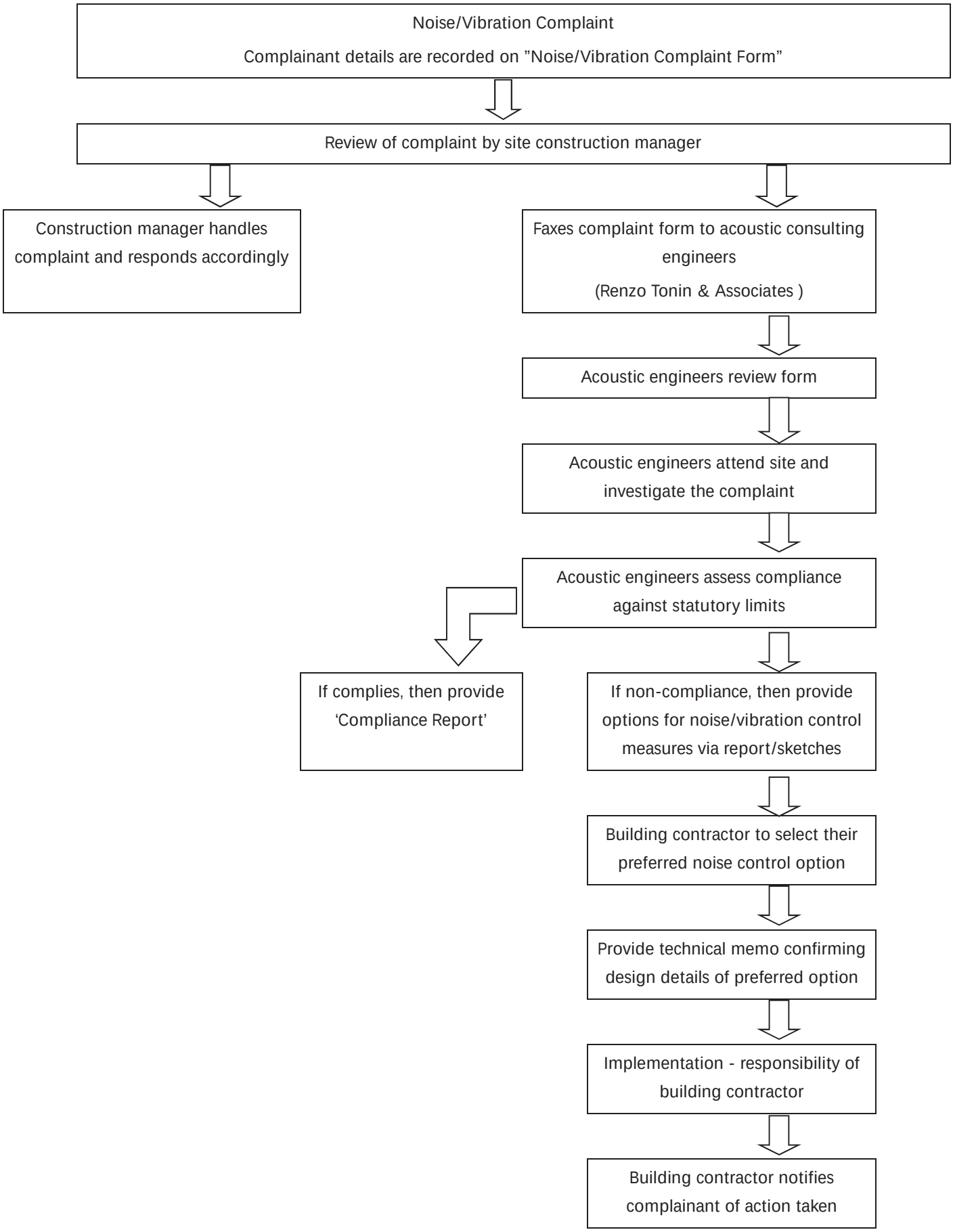
- Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest, closest to the vibrating plant.
- The surface should be solid and rigid in order to best represent the vibration levels entering the structure of the building under investigation
- The vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces
- The vibration sensor or transducer shall be directly mounted to the vibrating surface using either bees wax or a magnetic mounting plate onto a steel washer, plate or bracket which shall be either fastened or glued to the surface of interest
- Where a suitable mounting surface is unavailable, then a metal stake of at least 300mm in length shall be driven into solid ground adjacent to the building of interest, and the vibration sensor or transducer shall be mounted on that

The following information shall be recorded:

- Date and time of measurements
- Type and model number of instrumentation
- Description of the time aspects of each measurement (ie sample times, measurement time intervals and time of day)
- Sketch map of area
- Measurement location details and number of measurements at each location
- Operation and load conditions of the vibrating plant under investigation

- Possible vibration influences from other sources (eg domestic vibrations, other mechanical plant, traffic, etc)

APPENDIX G Noise / vibration complaint management procedure


Noise/Vibration Complaint
Complainant details are recorded on ”Noise/Vibration Complaint Form”
Review of complaint by site construction manager
Construction manager handles complaint and responds accordingly
Faxes complaint form to acoustic consulting engineers
(Renzo Tonin & Associates)
Acoustic engineers review form
Acoustic engineers attend site and investigate the complaint
Acoustic engineers assess compliance against statutory limits
If complies, then provide ‘Compliance Report’
If non-compliance, then provide options for noise/vibration control measures via report/sketches
Building contractor to select their preferred noise control option
Provide technical memo confirming design details of preferred option
Implementation - responsibility of building contractor
Building contractor notifies complainant of action taken

NOISE/VIBRATION COMPLAINT FORM							
COMPLAINANT'S DETAILS							
Date :		Received by (tick a box) :	Phone ☐ Written in ☐ Person ☐				
Complaint Received By:			Complainant's Name:				
Complainant's Address:							
Complainant's Contact Numbers:	Home:		Work:		Mob:		
COMPLAINT DETAILS							
Describe when the problem occurred (date and time), what equipment caused the complaint (if known) and where person was standing when he/she experienced the noise/vibration:							
INVESTIGATION							
Question foreman responsible on site and obtain information on what equipment or processes would most likely have caused the complaint:							
Please fax this form to Renzo Tonin & Associates Pty Ltd for processing after obtaining approval from the Project Manager - Fax: (02) 8218 0501							