CARDINIA MOTOR RECREATION & EDUCATION COMPLEX
DEVELOPMENT PLAN ACOUSTIC REVIEW

MARSHALL DAY Acoustics

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Marshall Day Acoustics Pty Ltd
ABN: 53 470 077 191
6/448 Roberts Road
Subiaco WA 6008
Australia
T: +618 9779 9700
www.marshallday.com

Project: **CARDINIA MOTOR RECREATION & EDUCATION COMPLEX**

Prepared for: **Podium 1 Pty Ltd**
PO Box 454
Northcote VIC 3070

Attention: **Felicity Richardson**

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EXECUTIVE SUMMARY

Podium 1 Pty Ltd (Podium 1) are proposing to develop the Cardinia Motor Recreation & Education Complex on land located at 21 Key Lane, 75 Key Lane, 115 Key Lane and 335 McGregor Road, Pakenham. A high-level review of noise considerations associated with the proposed complex has been undertaken for the purpose of the Development Plan submission. Separate noise assessments would be prepared for any subsequent Planning Permit applications.

The key source of noise associated with the development is competition motorsport on the main circuits and karting circuit. In Victoria, there are no policies or guidelines which set mandatory requirements or noise limits for competition motorsport noise. In lieu of such policies, noise from these types of facilities is usually managed using mitigation strategies that are tailored to the context of each facility.

Competition motorsport is an inherently high noise level activity. This is reflected in the results of preliminary noise modelling for the site which indicates a range of noise mitigation strategies should be implemented to manage motorsport noise associated with the development. These mitigation strategies should be implemented to address noise levels at the nearest receivers, as well as distant receivers located to the north, west and south the subject site.

A key point of context is that the land is zoned SUZ5 which promotes the development of a motor recreation and education facilities and the surrounding areas are proposed to undergo significant changes in the future. Future changes include the construction of new arterial roads and the creation of employment precincts to the west, north and east. In particular, it is understood that these changes will mean that some of the nearest properties to the site will no longer be used for residential purposes. Development of new precincts around the site are also focussed on employment uses and additional sensitive receivers are therefore considered unlikely (any planning applications for new noise sensitive locations would also need to account for the noise of the motorsport uses that are promoted for the site). For these reasons, the strategy to manage competition motor sport noise is proposed to include interim measures for the nearest receiver locations which are expected to undergo a change of land use in the future. The purpose of these interim measures would be to address noise levels during any overlapping period in which the development is operational while the nearest receiver locations remain in place. Interim measures may involve a range of strategies, such as localised noise treatments at residential properties and additional restrictions on events that can be held while the uses of the surrounding area are in transition. The use of interim noise measures would require consultation and agreements with relevant stakeholders including landowners and the responsible authorities.

The proposed measures for managing the noise of competition motorsport also include:

- Engineering measures in the form of noise barriers where effective reductions can be achieved with reasonable and practical structures; and/or
- Managerial measures such as restrictions on hours of operation, limits on the number of events which occur during the year, scheduling restrictions, vehicle noise emission limits and ongoing community consultation.

Commercial uses of the circuits would also need to be addressed as part of any subsequent planning permit application and factored into the overall noise management strategy for the development. Specifically, the noise associated with commercial uses of the main circuits and karting circuit (e.g. driver education, kart hire, driver experience days and corporate events) is assessable under Victorian EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV). Preliminary noise assessments indicate that the NIRV recommended levels can be met provided that the broader measures for competition motorsport are supplemented with dedicated managerial measures for each type of commercial use proposed.

The suite of mitigation measures to be used to manage competition and commercial motorsport noise are to be developed in detail during subsequent assessment stages for the project. This will involve consultations with relevant stakeholders and detailed assessments for the range of motorsport proposed at the site.

In addition to motorsport, other key sources of noise associated with the site include but may not be limited to a shooting range (indoor and outdoor ranges), outdoor concerts and a helipad. Details of relevant policies and guidelines have been outlined in this report. Preliminary assessments indicate that the noise of these sources can be managed to comply with the applicable criteria. As with the motorsport elements of the project, the mitigation measures to be used to manage noise will require further assessment as part of subsequent stages of the project and relevant planning permit applications.

The review has primarily considered the development of a new motorsport recreation and complex at the subject site. The broader uses of the subject site are anticipated to involve relocation of club motorsport activities which currently occur on and around the subject site to other parts of the subject site. While no specific assessment of these existing activities has been undertaken as part of this review, the assessment principles outlined within this report would apply equally to the relocated uses at the site. Further, if and when a planning permit application is lodged to relocate these activities, it is recommended that these applications include an acoustic assessment, and that the assessments are conducted on a cumulative basis in order to account for the overall motorsport noise of the subject site.

The suite of measures that are used to address the range of potential uses at the site are proposed to be documented in a noise management plan which would form part of the overall environmental management plan for the site. Recognising the planned developments in the area around the site, the processes for implementing the noise management plan should allow the flexibility for the plan to be adapted and updated in line with changes to the land use of the surrounding areas.

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1.0 INTRODUCTION

Podium 1 Pty Ltd (Podium 1) are proposing to develop the Cardinia Motor Recreation & Education Complex (hereafter referred to as the development) on land located at 21 Key Lane, 75 Key Lane, 115 Key Lane and 335 McGregor Road, Pakenham (subject site).

The approval process for the development involves:

- Submission of a Development Plan prepared in accordance with Schedule 16 to the Development Plan Overlay of the Cardinia Planning Scheme (DPO Schedule 16); and
- Submission of separate planning permit applications for the various elements of the development.

This report has been prepared for the Development Plan Submission and presents a high-level review of noise considerations associated with the potential development and use of the land for a motorsport complex, along with other potential use and development scenarios, as promoted by the land zoning for the site. The information presented in this report includes:

- An overview of the development and noise sources to be assessed
- An overview of relevant noise policy and guidance
- Indicative noise modelling for key aspects of the development
- An outline of the mitigation strategies which could be adopted to manage noise from the development.

Separate noise assessment reports should be prepared for any subsequent planning permit applications, providing further details including additional noise modelling results and proposed noise mitigation strategies for the site.

The review has primarily considered the development of a new motorsport recreation and complex at the subject site. The broader uses of the subject site are anticipated to involve relocation of club motorsport activities which currently occur on and around the subject site to other parts of the subject site. While no specific assessment of these existing activities has been undertaken as part of this review (along with other specific potential uses of the site), the assessment principles outlined within this report would apply equally to the relocated uses at the site. Further, if and when a planning permit application is lodged to relocate these activities, it is recommended that these applications include an acoustic assessment, and that the assessments are conducted on a cumulative basis in order to account for the overall motorsport noise of the subject site.

Acoustic terminology used throughout this report is detailed in Appendix A.

2.0 DEVELOPMENT PLAN

2.1 Site description

The subject site is located at 21 Key Lane, 75 Key Lane, 115 Key Lane and 335 McGregor Road, Pakenham. An aerial photograph of the site and surrounds is shown in Figure 1.

Figure 1: Aerial photograph showing subject site location (image courtesy of Nearmap)

The site is currently undeveloped and part of it is used for recreational motorsport activities by the Pakenham Auto Club and the Koo Wee Rup & District Motorcycle Club. A close-up aerial photograph of the site is presented in Figure 2, which shows the existing race tracks on site.

Figure 2: Close-up aerial photograph with existing race tracks visible (image courtesy of Nearmap)

Training and race events currently held on site include:

- Victorian Club Autocross Series
- Victorian Motorkhana Championships
- Victorian Khanacross Championships
- Trailbike club events and state championships
- Trailbike training and open days.

2.2 Planning and development context

The subject site is shown on the planning scheme map as SUZ5, defined under Schedule 5 to the Special Use Zone of the of the Cardinia Planning Scheme as the Cardinia Motor Recreation and Education Park. The purpose of the zone is:

> *To provide for the use and development of a motor recreation and education facility.*
>
> *To provide for complementary recreation and community uses.*

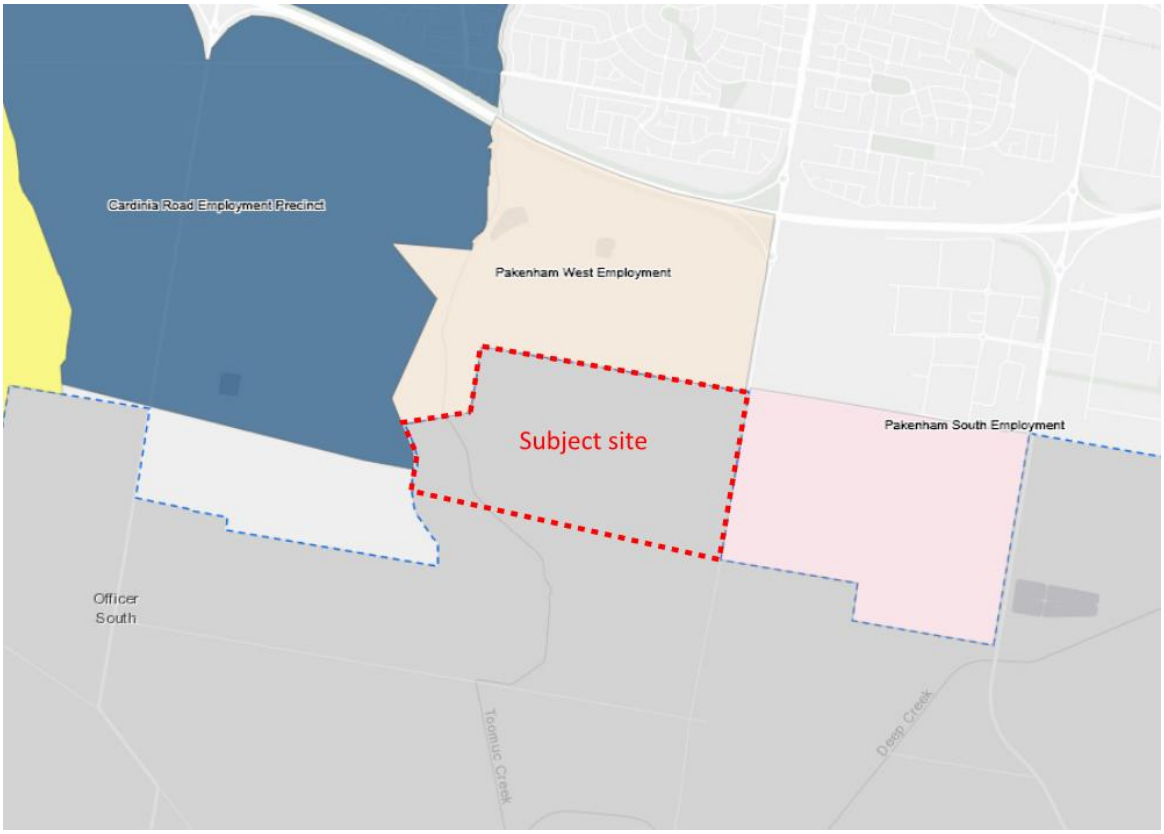
The current land zoning around the site comprises Urban Growth (UGZ & UGZ2), Industrial 1 (IN1Z) and Green Wedge (GWZ1). The site falls just outside the Melbourne Urban Growth Boundary (UGB) (the current UGB passes along the west and north boundaries of the site).

A planning scheme map showing the zoning of the site and the UGB is provided in Appendix E.

The surrounding areas are proposed to undergo significant development in the future. Key future developments include:

- Bypass route: a new freeway passing through the site to connect the Princess Freeway with Koo Wee Rup Road. Advice from the project team indicates that current expectations for the development of this route to commence in 10+ years (dependent on government funding)
- Thompsons Road upgrade: construction of a new freeway along the northern boundary of the site, connecting Greenhills Road and Cardinia Road
- Relocated Pakenham Auto Club (PAC) and Kooweerup and District Motorcycle Club (KMC): events associated with these clubs are proposed to be relocated to the eastern and southern sections of the subject site
- Employment precincts: land to the west, north and east of the site are the subject of approved and planned Precinct Structure Plans (PSPs) which provide a framework for the development of a range of new uses with a focus on employment generating activities. The PSP areas are illustrated in Figure 3. The following summarise the status of the PSPs based on public records and advice from the project team:
  - Cardinia Road Employment Precinct: the PSP was completed in 2010 and the land is ready to be developed for employment generating land uses.
  - Pakenham West Employment Precinct: the PSP for this area is scheduled to be initiated in the next 5 years
  - Pakenham South Employment Precinct: the PSP has been commenced and is due to be completed within 5 years.

Figure 3: Approved and pending Precinct Structure Plans



The extent of the proposed land use changes and development around the subject site are relevant to the assessment of noise levels from activities at the subject site. In particular, these developments will mean that some of the nearest properties to the site will no longer be used for residential purposes. Conversely, the development of new precincts may involve the introduction of new noise sensitive receivers (residential and non-residential).

The introduction of new major roads and employment generating activities will also alter the ambient noise environment around the subject site.

2.3 Potential future development and land uses

The potential future development of the land is anticipated to host a range of activities, including:

- Competitive motorsport (car and motorcycle circuit racing, go kart racing)
- Drag and drift nights (street cars only, no “funny cars” or “top fuel”)
- Social car and motorcycle clubs
- Public go kart hire
- Driver education and training
- Shooting club
- Live music events
- Other activities (including but not limited to motoring product launches, cycling, etc.).

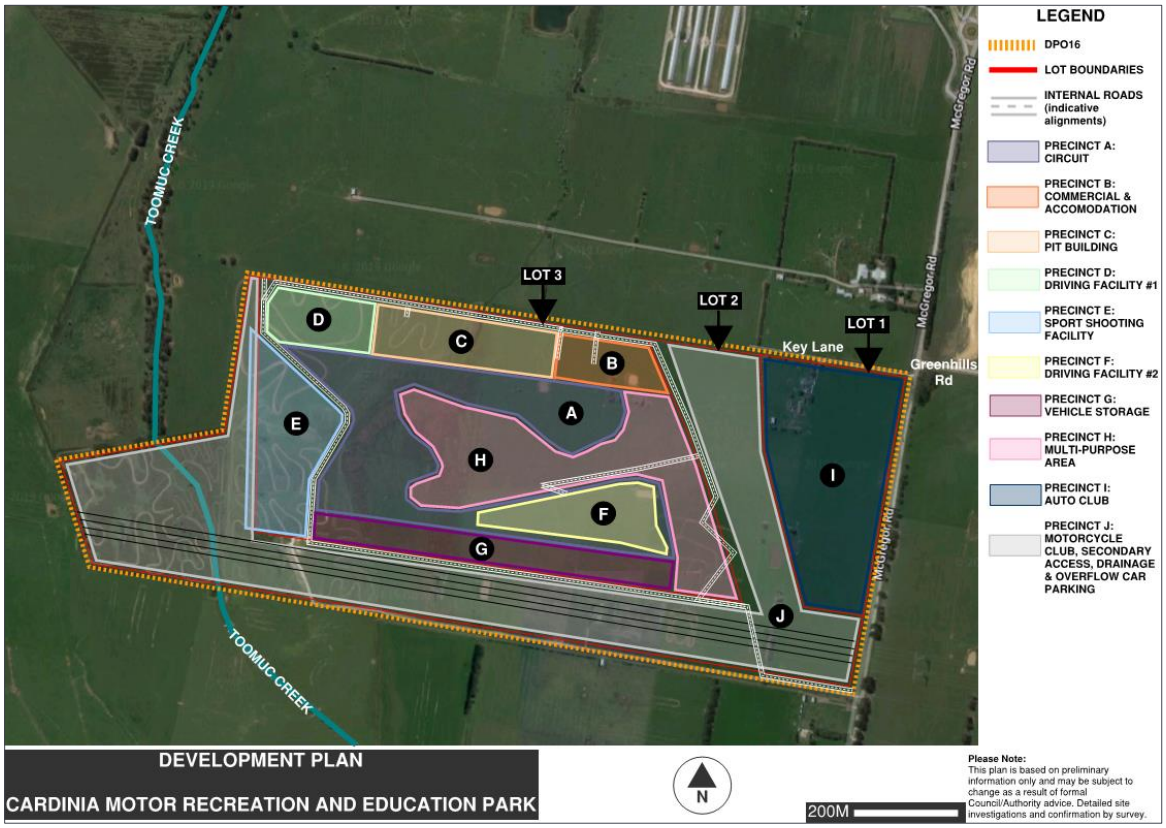
To host the above activities, it is anticipated that the site may include the following infrastructure:

- Main racing circuit (configurable for different uses – see Section 2.4)
- Driver experience/training centre (including kick plate, lane change, skid circle and off-road area)
- Pit buildings (garages, race control, medical centre, hospitality spaces)
- Indoor and outdoor shooting ranges
- Temporary stage facilities for outdoor concerts
- Hotel accommodation (including a wellness centre, spa and pool)
- Hospitality spaces (bars, restaurants, catering kitchens)
- Helicopter landing pad
- New roads and accessways
- Offices and store rooms.

The proposed development plan of the site illustrating potential land uses is shown in Figure 4. The review has primarily considered the development of a new motorsport recreation and education complex at the subject site. The broader uses of the subject site are anticipated to involve relocation of club motorsport activities which currently occur on and around the subject site to other parts of the subject site. While no specific assessment of these existing activities has been undertaken as part of this review (along with other specific potential uses of the site), the assessment principles outlined within this report would apply equally to the relocated uses at the site. Further, if and when a planning permit application is lodged to relocate these activities, it is recommended that these applications include an acoustic assessment, and that the assessments are conducted on a cumulative basis in order to account for the overall motorsport noise of the subject site.

The new motorsport recreation and education complex that is the focus of this review is located in the area designated as Lot 3 in Figure 4. The existing club motorsport activities which may be relocated within the subject site are allocated to the areas designated as Lot 1 and Lot 2 in Figure 4.

Figure 4: DPO16 development plan



2.4 Site operations

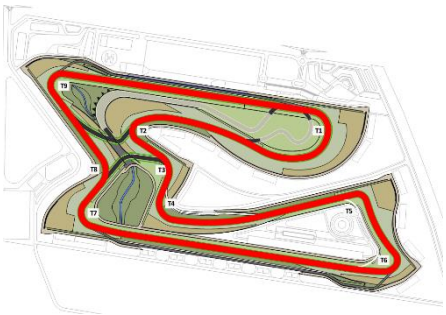
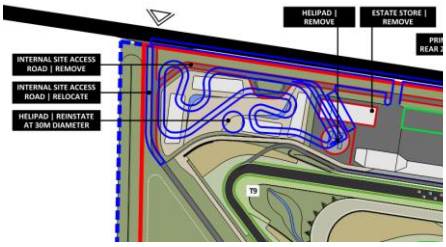
Details of the site uses described in Section 2.3 are to be developed as part of the planning applications and subsequent assessment phases of the project, accounting for operational requirements and environmental considerations including noise. Particular details to be developed as part of these subsequent phases would include:

- Hours of operation
- Number and frequency of different event classifications
- Allowable noise emissions for different classes of operation (e.g. numbers of vehicles and allowable emissions of different vehicle classes).

Indicative track configurations for the various motorsport racing, testing and training uses, which may be included on Lot 3 of the site, are outlined in Table 1. The descriptions provide an indication of the typical anticipated uses proposed, however a degree of flexibility is expected to be necessary and general usage profiles will be refined as part of the planning permit applications and subsequent design phases.

The potential relocation of existing club motorsports at and around the subject site to Lots 1 and 2 of DPO16 should also be considered as part of any future planning applications, accounting for cumulative motorsport noise.

Table 1: Indicative track use descriptions (corresponding track profiles indicated in red, except for the indicative kart track which is indicated in blue)

Track permutation	Description	Track profile
International	Details: - FIM Grade B / FIA Grade 2 circuit - 3.6 km Track uses: - Regular car club meetings, production car testing, product launches, private hire, driver training, etc. - Occasional supercars and superbikes race events	
National	Details: - FIA Grade 2 circuit - 1.6 km Track uses: - Regular car club meetings, production car testing, product launches, private hire, driver training, etc. - Occasional drag and drift racing (street cars)	
Rallycross	Details: - 6R Rallycross circuit - 1.4 km Track uses: - Occasional rallycross events	
Driver Experience Centre	Details: - FIA Grade 2 - 2.0 km Track uses: - Driver training, product launches - Typically, standard production cars and sports cars	
Go Kart Track	Details: - 0.9 km Track uses: - Regular private hire, driver practice and corporate use - Occasional race events	

2.5 Potential noise sources

The following potential noise sources associated with the site have been identified:

- Competitive motorsport track use
  - Race cars
  - Race motorbikes
  - Modified street cars (car clubs, drag and drift races)
  - High performance karts
- Non-competitive track use
  - Production cars (driver education training, manufacturer testing, product launches)
  - Standard karts (public/corporate hire)
- Shooting range
  - Outdoor clay targets
  - Indoor range
- Music concerts
- Helicopter noise
- Public address systems
- Other commercial uses (hotel, bars, restaurants, etc.).

The above sources relate to the motorsport recreation and education complex development at Lot 3 of the subject site. As part of any future planning permit applications for the subject site, consideration may also need to be given to potential relocated existing club motorsport activities to Lots 1 and 2 of the subject site.

2.6 Noise sensitive receivers

The nearest existing noise sensitive receivers to the site are marked in Figure 5. It is understood that the residential property currently located at the northeast of the DPO16 site, 335 McGregor Road, will be removed as part of the development of the site.

The majority of the receivers are existing residential dwellings, with the nearest dwellings located to the northeast, east and southeast of the site.

Receiver details including addresses and descriptions are listed in Table 2 below. Those located within the UGB of Melbourne are noted.

Figure 5: Aerial photograph showing subject site location and nearest receivers (image courtesy of Nearmap)

In light of proposed future developments around the subject site (discussed in Section 2.2), some receiver locations will cease to be used for residential purposes in the future. Previous advice from the Cardinia Shire Council has indicated the following future changes:

- Receiver 7 (415 McGregor Road): this dwelling is in the corridor of the proposed bypass route and is therefore expected to be removed
- Receiver 2 (317 McGregor Road) and Receiver 3 (30 Greenhills Road): these dwellings are expected to cease being used for residential purposes in the future.

The above are examples of potential changes which could significantly influence the appropriate form of noise management for the proposed use of the subject site (i.e. as a result of a reduction in the number and/or proximity of noise sensitive receivers). Other land use changes are expected, which may include removal of other sensitive uses. Employment opportunities will be the focus of future development. While noise sensitive land use might be considered within these areas (e.g. residential, schools or nurseries), it is anticipated that such uses would need to account for the motorsport activities promoted within DPO16.

Table 2: Details of the nearest noise sensitive receivers

ID	Address	Description	Within Urban Growth Boundary	Approximate distance to subject site boundary
1	245 McGregor Road	Residential	✓	840 m
2*	317 McGregor Road	Residential	✓	160 m
3*	30 Greenhills Road	Residential	✓	315 m
4	40 Greenhills Road	Residential	✓	385 m
5	54 Greenhills Road	Residential	✓	530 m
6	60 Greenhills Road	Residential	✓	605 m
7*	415 McGregor Road	Residential	×	100 m
8	490 McGregor Road	Residential	×	780 m
9	494 McGregor Road	Residential	×	890 m
10	500 McGregor Road	Residential	×	955 m
11	515 McGregor Road	Residential	×	1,050 m
12	315 Watson Road	Buddhist Temple	×	1,060 m
13	255 Watson Road	Residential	×	1,080 m
14	145 Watson Road	Residential	×	950 m
15	105 Watson Road	Residential	×	1,200 m
16	95 Watson Road	Residential	×	1,120 m
17	495 Cardinia Road	Residential	×	1,400 m
18	450 Cardinia Road	Residential	×	1,520 m
19	395 Cardinia Road	Residential	✓	1,440 m
20	365 Cardinia Road	Residential	✓	1,470 m
21	295 Cardinia Road	Residential	✓	1,600 m
22	285 Cardinia Road	Residential	✓	1,960 m
23	92 Enterprise Road	Residential	✓	1,550 m

** example dwellings identified, which may no longer be used for residential purposes in future*

3.0 NOISE POLICY AND GUIDELINES

The section presents an overview of the policies and guidelines that are relevant to the assessment of operational noise from the different components of the potential future development and use of the site.

3.1 Competition motorsport

There are no specific regulatory requirements, standards or guidelines which establish noise limits or criteria for motorsport facilities in Victoria.

For example, *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP-N-1) does not apply to motorsport, as sporting events are listed as a type of commercial, industrial or trade premises which are not assessed under the policy.

Similarly, EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV) also notes that noise from sporting events are not assessed under the guidelines (but provides advice about the assessment of motorsport vehicle testing, as discussed subsequently in Section 3.2 of this report). This is confirmed in the accompanying EPA Publication 1414 *Response to Comments – Noise from Industry in Regional Victoria* which states the following in connection with competition motorsport:

> *Noise from sporting events is not assessed under SEPP N–1. It is also not assessed under NIRV.*

In lieu of specific Victorian policies, motorsport noise is generally managed and assessed using a combination of assessment principles guided by Victorian references and example interstate approaches. A selection of reference documents is provided in Table 3.

Table 3: Example Australian motorsport noise management references

State / Territory	Reference	Note
Victoria	EPA general information paper *Noise from Motor Sport* (19 May 1992)	Provides an overview of general environmental noise considerations as part of a discussion of lower and upper bounds of criteria for the assessment of motorsport noise.
	Calder Park Raceway amended planning permit (July 2004)	Sets out detailed measures to manage noise from a long established motorsport venue in the outer suburbs of Melbourne. Includes details relating to numbers of events, scheduling of events, and noise limits for different times.
Australian Capital Territory	*Motor Sports Noise Environment Protection Policy* (2002)	Policy developed to address noise from two existing motorsport facilities. The basis of the policy is that noise from the facilities cannot practically operate within noise limits applied to other types of noise sources, and therefore an alternative approach is provided to balance amenity protection and operation of the facilities. The policy provides a framework for limiting noise levels, the number of events and the times when events can occur.
New South Wales	EPA *Noise Guide for Local Government* (2013)	Provides a case study example of an approach used to manage noise from a motorsport venue involving drag racing and circuit racing. The example illustrates an approach for dealing with noise levels, the number of events and the time when events can occur.

State / Territory	Reference	Note
Queensland	*Planning for shooting and motor sport facilities* (November 2016); and	Provides noise guidance for existing and planned motorsport facilities (and noise sensitive development in the vicinity of existing or approved motorsport facilities). Identifies that planning instruments to address noise will vary to reflect local context and provides example guidance based on separating distances.
	Environmental Protection Act 1994	The EP Act contains provisions for open-air events.
Western Australia	*Environmental Protection (Noise) Regulations 1997;* and The Department of Environment Regulation[1] publication *Guide to Management of Noise from Motor Sport Venues* (July 2014)	Outlines a mechanism for motorsport venues to obtain a special approval which allows venues to exceed noise limits under the Regulations, provided that the venue operates in accordance with an approved Noise Management Plan.

Further information about each reference is provided in Appendix B.

The most stringent approach to noise control in these references (e.g. the example approach detailed in the NSW Local Government Guidelines) involves setting environmental noise limits based on allowable margins above the background noise level in the area. These margins are then used to inform how many events are allowed to occur throughout the year, and the times when these events can occur. This type of approach offers the benefit of a well-defined procedure for setting limits for noise levels and event numbers. However, it is unclear whether this type of limit structure could be practically achieved by major urban motorsport venues in Victoria. Further, it is not well established that the procedures used for adjusting the allowable number of events per year (e.g. both the NSW Guidelines and the ACT Policy) accurately reflect changes in community tolerance of motorsport noise with variations in facility usage.

The Queensland guide is the only reference to nominate a separating distance between motorsport facilities and noise sensitive land use. In providing this advice, the guide notes that planning instruments to address noise will vary to reflect local contexts, and it is not possible to prescribe a specific separation distance which is applicable in all cases. The guide therefore notes that where separating distances are defined, they should be interpreted as recommended triggers for conducting detailed noise assessments. In the case of motorsport facilities, the guide refers to an example separation distance of 2 km, and that smaller separation distances require assessment to be undertaken to assess whether and how 'acoustic quality objectives' can be met at sensitive receivers. The 'acoustic quality objectives' equate to relatively low noise levels (e.g. 50 dB L_{Aeq} during the day). However, the Queensland Environment Protection Act contains a provision for open-air events with daytime noise levels up to 70 dB L_{Aeq} which has been applied to established motorsport facilities.

[1] Now called the 'Department of Water and Environmental Regulation'

In terms of example noise guideline values considered in Victoria, the 1992 general information paper refers to a level of 50 dB L_{Aeq} as an indication of a lower bound for criteria which would be unlikely to cause significant intrusion to residents during the day (based on comparisons with noise limits used for assessing industry). At the other end of the range, the Victorian information paper refers to 65 dB L_{Aeq} as a maximum acceptable criterion for circuit racing during day time hours. The value of 65 dB L_{Aeq} as an upper bound shares similarities with other reference documents. For example:

- The only example of Victorian legislation which sets limits for periodic outdoor events which generate high levels specifically relates to outdoor concerts (see discussion of SEPP N-2 subsequently in Section 3.4). The requirements are specific to concerts however, as an indication, of legislated noise limits for this type of event, SEPP N-2 specifies a limit of 65 dB L_{Aeq} for outdoor concerts
- The upper bound of 65 dB L_{Aeq} is comparable to the value defined in the ACT policy, as the limit which no single event is allowed to exceed
- The noise limits defined in the Calder Park Raceway planning permit adopts 65 dB L_{Aeq} as a reference value for circuit racing under neutral weather conditions.

A common theme of the references outlined above is recognition of the inherent high noise levels associated with motorsport, and the adoption of noise management mechanisms that are tailored to the planning context of the site in question. The use of reasonable and practical measures to minimise amenity impacts to surrounding areas is a central element of these references.

In lieu of defined assessment criteria, the above references can be used to guide the assessment of competition motorsport noise. A priority design objective is to avoid instances of external noise levels at sensitive locations higher than 65 dB L_{Aeq} during the day time. Recognising that the 65 dB L_{Aeq} value is commonly referenced in the context of existing motorsport facilities, a new development should seek to achieve lower noise levels where practicable.

The acceptability of noise levels below 65 dB L_{Aeq}, and events which occur during more sensitive times of day, will be dependent on factors such as the margin above background noise and the scheduling of events. Therefore, in addition to the design objective noted above, controls for the number of events, the regularity of events and the times when events can occur would need to form part of an overall suite of measures to manage motorsport noise. These types of managerial measures are particularly important where concessions are sought for events during evening hours.

3.2 Commercial activities

The primarily legislation for assessing noise levels from commercial, industrial and trade premises within the Melbourne metropolitan area is SEPP-N-1. However, the subject site is located outside of the SEPP N-1 boundary which defines the areas where the legislation is applicable.

For locations outside of the SEPP N-1 area of application, the relevant guidelines for the assessment of noise from commercial, industrial and trade premises is NIRV.

The stated purpose of the recommended maximum noise levels (recommended levels) outlined in NIRV are to:

> *…provide a balance between protecting community wellbeing and amenity near industrial premises and supporting the social and economic value of industry in regional Victoria.*

The NIRV recommended levels would apply to the commercial operations which occur on the site and would therefore cover noise sources such as mechanical and electrical plant items associated with site facilities. While the preceding section notes that the recommended levels would not apply to competitive motorsport such as major events, NIRV indicates that other aspects of circuit use are assessable using the recommended levels.

For example, where NIRV states that the recommended levels do not apply to sporting events, a note is provided as follows:

> *Noise from motorsports vehicle testing at a motorsport venue may be assessed under these guidelines.*

EPA Publication 1414 provides further guidance on the subject noting:

> *… commercial vehicle testing not in association with a race event would not be considered a sporting event and the NIRV recommended levels would apply.*

Given the above, the NIRV recommended levels would apply to motorsport vehicle testing, as well commercial track usage other than sporting events. This would include activities such as vehicle product launches, driver experience days and driver training. The recommended levels would also apply to commercial uses of the karting circuit at the site (e.g. public kart hire and corporate events).

As the NIRV document is a non-statutory guideline, the recommended levels are only legally binding when applied through statutory instruments, such as a planning permit or notice.

The procedure for determining the recommended levels according to NIRV depends on whether the noise source or the receivers are located in a rural or major urban area. NIRV defines major urban areas as:

- *the part of Melbourne that extends beyond the SEPP N-1 area (see page 1), but is within the Melbourne Urban Growth Boundary — for example, parts of Pakenham, Belgrave, Mount Evelyn, Mount Eliza, Beveridge and Lilydale*
- *land within the 'Urban Centre boundary' (as defined by the Australian Bureau of Statistics) of an Urban Centre with a population greater than 7000.*

NIRV notes the applicable Urban Grown Boundary (UGB) corresponds to the definition which was in place at the time of publication of NIRV in 2011, or as varied by the EPA. In the areas that are relevant to the subject site, comparison of the UGB in place in 2011 with the current UGB indicates the two are equivalent. Therefore, referencing the planning map provided in Appendix E, the subject site lies outside of the UGB which passes near to the west, north and east boundaries of the subject site.

However, while some of the noise sensitive locations around the site are also outside of the UGB, the majority are located within the Urban Growth Boundary. To address this type of situation, NIRV notes that:

> *Where either the noise emitter or the noise receiver are within a major urban area, the major urban area approach applies.*

A mix of procedures therefore apply for determining recommended levels for receiver locations around the subject site. For the receivers located outside of the UGB (those broadly located to the south of the subject site), the recommended levels are determined using the NIRV procedures for rural areas. For all other receivers which are located inside the UGB, the recommended levels are determined using the technical procedures detailed in SEPP N-1.

Both methods of determining recommended levels are based on consideration of the background noise levels at the site and the composition of the land zoning in the area. Background noise levels and land zoning in the area are expected to change as a result of planned development in the surrounding area. The applicable NIRV recommended levels may therefore change in future (the changes would be expected to increase the recommended levels).

The recommended levels are then defined separately for the day, evening and night as summarised in Table 4.

Table 4: NIRV time periods for defining recommended levels

Period	Day of week	Start time	End time
Day	Monday-Friday	0700 hrs	1800 hrs
	Saturday	0700 hrs	1300 hrs
Evening	All days	1800 hrs	2200 hrs
	Saturday	1300 hrs	1800 hrs
	Sunday, Public holidays	0700 hrs	1800 hrs
Night	Monday-Sunday	2200 hrs	0700 hrs

The recommended levels apply to the effective noise level (L_{eff}) of the premises when assessed (using predictions or measurements) in accordance with the technical procedures set out in SEPP N-1. The effective level is the average noise level (equivalent level L_{Aeq}) over a half-hour period, adjusted if required for the character of the noise. Adjustments are made for duration, tonality, intermittency and impulsiveness.

3.3 Shooting range

Assessment criteria for outdoor shooting range noise is provided by EPA Publication 1508 *Noise From Outdoor Shooting Ranges* dated October 2012 (EPA Publication 1508).

For planned new outdoor ranges, the EPA Publication 1508 recommends gunshot noise levels at noise sensitive receivers as follows:

> *The gunshot noise level (measured as dB(A)I) should be below the recommended level in a noise sensitive area.*
>
> *For daytime, the recommended noise level is the higher of:*
>
> - *the daytime recommended level specified in table 1 for the appropriate number of days of shooting per week*
> - *the background sound level + 10 dB(A)I.*
>
> *For the evening, the recommended noise level is the higher of:*
>
> - *the evening recommended level specified in table 1 for the appropriate number of days of shooting per week*
> - *the background sound level + 5 dB(A)I.*
>
> *Shooting shall be restricted to the following hours:*
>
> - *Monday – Saturday 9am – 10pm*
> - *Sunday 12noon – 10pm.*

The recommended levels provided by EPA Publication 1508 relate to the average (logarithmic) maximum noise level of gunshot shots when measured using an impulse time response, expressed as the $L_{AImax(log\ average)}$ level. The recommended levels detailed in Table 1 of EPA Publication 1508 for planned outdoor ranges are reproduced in Table 5.

Table 5: EPA Publication 1508 recommended levels for outdoor shooting range noise, $L_{Almax(log\ average)}$

Description	Hours of operation	Days of shooting per week				
		< 1	1	2	3-5	6-7
Planned ranges (Day)						
Monday-Saturday	0900-1800 hrs	60	55	50	45	45
Sunday	1200-1800 hrs	55	50	45	45	45
Planned ranges (Evening)						
Monday-Saturday	1800-2200 hrs	55	50	45	40	35
Sunday	1800-2200 hrs	50	45	40	35	35

The number of days of shooting '<1' means no more than 1 day per month. If shooting occurs during both the day period and the evening period in a single day, it is counted as two days.

The "days of shooting per week" is interpreted as the "days per week the facility is open for shooting". The criteria are not intended to apply individually to different types of guns which may be used at the range less often.

The EPA Publication 1508 recommended levels apply to the noise that occurs within 20 m of the most-exposed external wall of the worst affected building on the noise-sensitive premises, which could include a residence, hotel, motel, hospital or caravan-park, where the long-term amenity of people may be affected.

For compliance assessment purpose, the recommended level is calculated as the logarithmic average of 40 gunshots or the average of all shooting over a 30 minute period, whichever occurs first.

The assessment must also be conducted when weather conditions favour the propagation of sound from the range to the receiver. That is, when wind and other meteorological effects cause the noise levels to be higher. Over large distances (>400 m), meteorological conditions can have a significant influence on environmental noise propagation.

The recommended levels provided by EPA Publication 1508 apply to the noise associated with outdoor shooting ranges. In relation to the potential indoor range associated with future use of the site, there are no specific Victorian policies or guidelines. It also noted that both SEPP N-1 and NIRV specifically exclude assessment of noise from firearms. However, the EPA Publication N6/91 *Interim Gunshot Noise Guidelines* dated February 1991 (EPA N6/91) which preceded EPA Publication 1508 provided general guidance for shooting ranges and contained the same approach to defining recommended levels. While the discussion in N6/91 considers the buffer and planning constraints that are specific to outdoor shooting ranges, the shooting ranges that the guidance applied to were defined as:

> *Any rifle, pistol or shotgun range whether used for sport/recreation or for firearms training or practice.*

Accounting for the above, and considering the range of the recommended levels defined by EPA 1508 for planned ranges, it is expected that design and assessment of the indoor range to levels equal to or below the recommended levels would be appropriate.

Background noise levels in the area are expected to change as a result of planned development in the surrounding area. The applicable EPA Publication 1508 recommended levels may therefore change in future (the changes would be expected to increase the recommended levels).

3.4 Outdoor concerts

The noise of outdoor concerts in Victoria is regulated by mandatory requirements detailed in *State Environment Protection (Control of Music Noise from Public Premises) Policy No. N-2* (SEPP N-2).

The requirements apply to outdoor venues which are defined as:

> *public premises, not being an indoor venue, where music is played in the open air…*

The provisions of SEPP N-2 would therefore be applicable to the noise of outdoor concerts hosted within the subject site.

The noise limit which applies to outdoor venues is 65 dB L_{Aeq} when measured outside a noise sensitive receive location, or 55 dB L_{Aeq} when measured indoors at noise sensitive receiver location.

SEPP N-2 specifies that the operation of an outdoor venue may only take place during the period 1200-2300 hrs, except where the duration of the operation is greater than five hours, in which case the operation may only take place in the period 1200-2200 hrs.

Under SEPP N-2, no more than six concerts may be conducted at an outdoor venue in a financial year. The Environment Protection Authority may allow more than six concerts where:

> *(a) an application in writing to the Authority is made by the occupier at least 45 days before the first concert to which the application refers;*
>
> *(b) the application referred to in clause (a) specifies the days on which the extra concerts are sought;*
>
> *(c) an abatement plan, approved by the Authority, has been implemented by the occupier; and*
>
> *(d) the applicant has obtained the written advice of the local municipality and submitted it to the Authority.*

3.5 PA system noise

Noise from PA systems is covered under Victorian EPA Publication 1254 *Noise Control Guidelines* dated October 2008 (EPA Publication 1254).

EPA Publication 1254 provides the following objectives for the management of PA system noise:

> *In all cases, the environmental objective should be noise intrusion of not more than 5 dB(A) above background at any affected residences or other noise-sensitive locations. Corrections for tonal or impulsive noise usually are not necessary, and further tolerance of up to 5 dB(A) may be allowed for unique or very infrequent activities with recognised social merit.*
>
> *Amplifier level settings must be minimised whilst ensuring conveyance of information to audience or participants is adequate. Restrictions on the times of use of public address systems should be considered. Noise from PA systems must not be audible inside a residential dwelling during normal sleeping hours.*

The objectives are non-statutory and are therefore not mandatory unless they are implemented as a licensing requirement or a planning approval condition.

As well as the objectives noted above, general guidelines for reducing noise is provided for two broad categories of PA systems:

- low-power units needed for control of persons engaged in the activities or events; and
- high-power units used for making public commentaries and announcements.

Extracts of the relevant guidance for each category is reproduced in Appendix C.

3.6 Helicopter movements

There is no legislation in Victoria for the control of noise associated with helicopter operations.

Victorian guidance relevant to the assessment of noise from helicopter operations is however provided in the EPA Publication 1254.

Section 16 of EPA Publication 1254 details the following with respect to noise from helicopters:

> *The criteria comprise three separate components, each of which should be satisfied at the nearest affected buildings:*
>
> - *The measured $L_{Aeq,T}$ (measured over the entire daily operating time of the helipad) shall not exceed 55 dB(A) for a residence.*
> - *The measured maximum noise level L_{Amax} shall not exceed 82 dB(A) at the nearest residential premises (See Note below).*
> - *Operation outside the hours between 7 am and 10 pm shall not be permitted except for emergency flights.*
>
> *Note: These levels will generally be met by a separation between the landing site and the residential premises of 150 m for helicopters of less than two tonnes all-up-weight, and 250 m for helicopters of less than 15 tonnes all-up-weight.*

3.7 Summary of policy and guidelines

The policies and guidelines relevant to each noise source associated with the proposed development are summarised in Table 6.

Table 6: Assessment policies and guidelines

Source	Victorian policy or guideline	Assessment basis
Competition motorsport	No applicable policies or guidelines	Related Victorian references and interstate guidelines. Reliance on implementation of reasonable and practical measures to minimise amenity impacts. Upper design objective of 65 dB L_{Aeq} at noise sensitive receivers.
Commercial activities (non-competitive motorsport and other commercial land uses such as hotels, bars, restaurants, etc.)	NIRV	Recommended levels for day, evening and night that apply at noise sensitive locations. Applicable to general commercial operations and commercial use of circuits.
Shooting ranges	EPA Publication 1508	Recommended levels for the day and evening that apply to noise at sensitive locations, and restrictions on times of use (e.g. no night shooting). Directly applicable to the outdoor shooting range. Adopted as a reference for the assessment of indoor range.
Outdoor concerts	SEPP N-2	Mandatory limits apply to the noise of outdoor concerts at noise sensitive locations.
PA system noise	EPA Publication 1254	Guidance in the form of noise level objectives and management measures to reduce environmental noise.
Helicopter movements	EPA Publication 1254	Guidance in the form of noise limits and restricted hours of use.

4.0 AMBIENT NOISE ENVIRONMENT

Existing ambient noise levels around the subject site have been surveyed to provide a reference for this study. Specifically, existing noise levels provide context to the environment in which the proposal is to be developed, and is used as a basis for setting objective noise criteria for some aspects of the development.

To evaluate existing noise levels, an extended logging survey was conducted from Friday 8 March to Tuesday 9 April 2019 at multiple locations around the subject site. The monitoring locations were chosen to provide a representation of noise levels for existing noise sensitive locations around the subject site. The survey locations are shown in Figure 6 and are described in Table 7 below.

Survey period was chosen to overlap with scheduled events by Pakenham Auto Club and the Koo Wee Rup & District Motorcycle Club to obtain an indication of existing levels of motorsport in the area. However, both events were cancelled and therefore survey results are primarily referenced to represent background noise levels.

Figure 6: Noise logger locations – surveyed premises circled red (image courtesy of Nearmap)

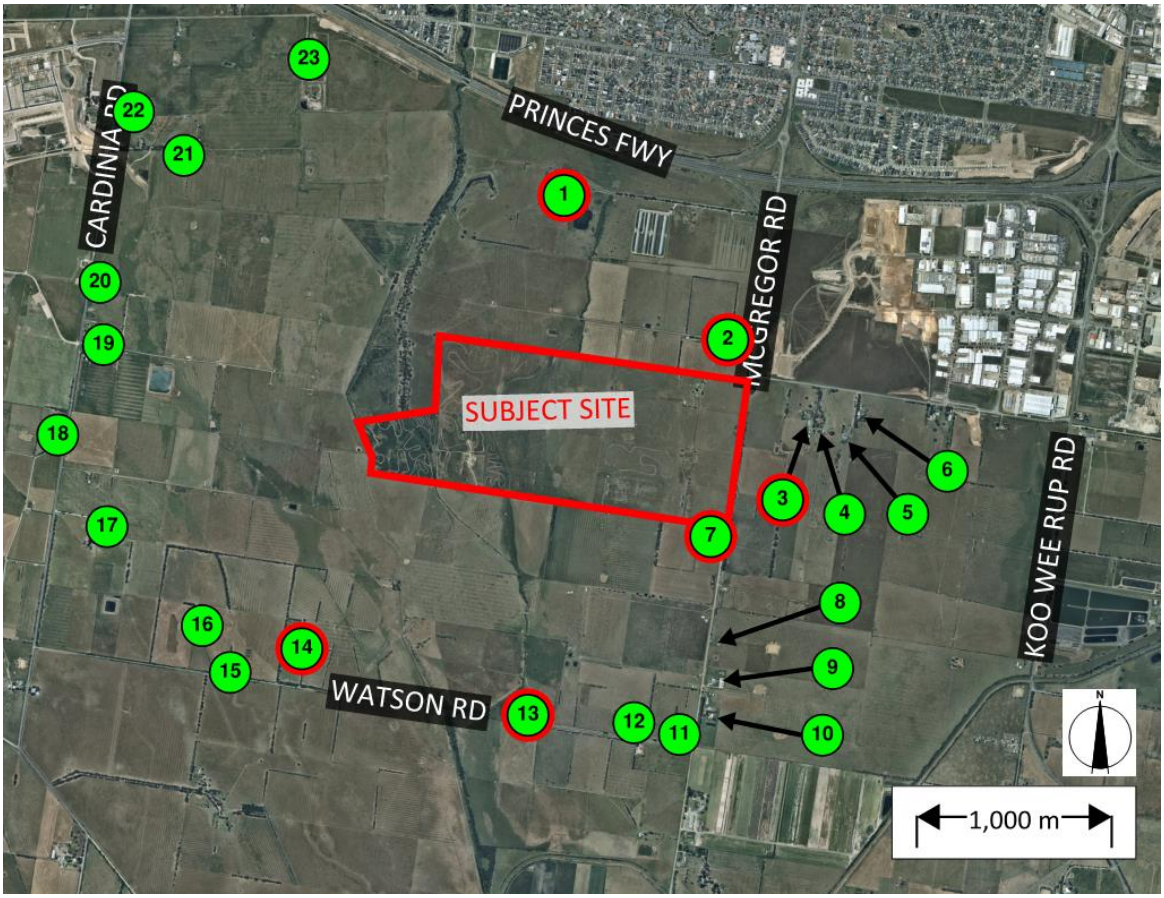


Table 7: Details of the noise survey locations

ID	Address	Description
1	245 McGregor Road	Residential
2	317 McGregor Road	Residential
3	30 Greenhills Road	Residential – survey location was on nearby public land at a location considered representative of the premises
7	415 McGregor Road	Residential
13	255 Watson Road	Residential
14	145 Watson Road	Residential

The survey comprised unattended noise monitoring to continuously measure noise levels and periodically record audio samples for the duration of the survey period. A local weather station was also used to continuously monitor wind speed, wind direction and rainfall. Full details of the instrumentation are provided in Appendix D.

In accordance with the relevant policies and guidelines for the assessment, the data was analysed to determine the underlying background noise levels for each consecutive 1 hour period, The background noise level represents the A-weighted noise level that is exceeded for 90 % of each 1 hour period, and therefore corresponds the underlying quieter periods of each hour. Any periods when rain or excess wind (average wind speeds greater than 5 m/s) was measured were removed from the analysis.

Environmental noise levels at the site are influenced by a range of sources including distant traffic on arterial routes (notably the Princes Freeway to the north), vehicle movements on the unsealed sections of McGregor Road, and local sources of noise around each property (e.g. wind in trees, insects and domestic noise sources). Noise levels are also influenced by existing club motorsport at and around the site. However, events which were scheduled during the monitoring period were cancelled. Occasional activity at the site is also unlikely to have significantly influenced underlying background noise levels which are primarily determined by quieter periods.

The background noise levels have been separately analysed for the time periods defined by NIRV and EPA Publication 1508. Full details of these results are provided in Appendix D.

A summary of the lower range of measured background noise levels for the day, evening and night periods are presented in Table 8. Note that the day periods in this summary include Saturday 1300-1800 hrs and Sunday 0700-1800 hrs, however for the purpose of setting recommended levels, these times are treated in the same way as evening periods.

Table 8: Background noise levels – daily period averaged dB L_{A90}

ID	Receiver address	Day 0700-1800 hrs	Evening 1800-2200 hrs	Night 2200-0700 hrs
1	245 McGregor Rd	46 - 51	45 - 49	45 - 47
2	317 McGregor Rd	42 - 47	43 - 47	41 - 47
3	30 Greenhills Rd	42 - 48	47 - 51	39 - 45
7	415 McGregor Rd	39 - 44	45 - 47	36 - 45
13	255 Watson Rd	39 - 42	42 - 48	28 - 41
14	145 Watson Rd	35 - 39	35 - 40	30 - 38

The results presented in Table 8 indicate background noise levels (i.e. lower noise levels during quieter periods, as referenced in Victorian guidelines and policies) are generally consistent with expectations for the area, with the quietest levels being measured along Watson Road locations which are furthest from arterial routes. Given the influence of distant road traffic noise on arterial routes such as the Princes Freeway, sample reviews of the data were carried to identify whether background noise levels were dependent on wind direction (i.e. background noise levels increasing or decreasing with wind direction); no clearly identifiable trends were evident in the data.

A consistent pattern of increased noise levels during the evening hours is evident in the measurements at the majority of locations, with the evening levels being comparable to, or higher than, those occurring during the day. These variations are likely to be related to changes in traffic flows and road usage in the area. While this effect was persistent throughout the survey, in advance of further analysis, it is unclear if the increased evening noise levels can be relied on as a persistent long-term effect throughout the year. To address this uncertainty, background noise levels used for defining recommended levels and noise targets in accordance with NIRV and EPA Publication 1508 are based on the lower values measured during the day periods.

Further, while the data provides an extensive representation of current background noise levels in the area, future development in the area may result in significant changes to the background noise environment. Aspects of future development which may alter background noise levels include the upgrade of existing roads (e.g. potential surfacing of McGregor Road) and the introduction of new road traffic routes in the area, including the bypass through the subject site and the proposed multi-lane arterial route along the north of the subject site. Road traffic flows associated with any new development in the area will also contribute to changes in the ambient noise environment. These potential changes would need to be factored into any longer-term noise management plans for the subject site.

5.0 NOISE ASSESSMENT – CIRCUIT USE

The planning application and subsequent design phases will involve detailed modelling of the full range of motorsport activities at the site.

At this stage in the project's assessment, indicative 3-dimensional environmental noise modelling has been carried out for the proposed circuit uses which would result in the highest noise levels. Specifically, competition racing use of the full international circuit and the proposed karting circuit.

The modelling for each of these scenarios has been conducted on a worst case basis assuming the highest noise emissions from the vehicles and assuming full use of each respective indicative circuit, without dedicated noise management measures. The objective of this modelling is to inform further design and assessment work required as part of the planning application for the development, and to provide an indication of the extent and type of noise mitigation measures that are likely to require further consideration as part of the development of the project.

Comparisons between commercial and competition motorsport noise emissions are then used to provide an indication of noise relating to the proposed commercial uses of the circuits.

The detailed modelling conducted as part of subsequent stages of the project would then inform the development of a comprehensive noise management plan, which would define the engineering and managerial tools to be used to address operational noise from the development.

5.1 Noise modelling methodology

A 3-dimensional digital model of the subject site and surrounding environment was developed using SoundPLAN proprietary modelling software (version 8.1).

Topographical and geometry data for the model was sourced from the project team, public sources (Google Earth), and aerial photography. The geometries in the model are simplified representations of the built environment that have been configured to a level of detail that is appropriate for noise calculation purposes.

The SoundPLAN model has been used to calculate noise levels using the International Standard ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613). ISO 9613 is a general environmental noise calculation standard that has been used extensively throughout Australia, New Zealand, and Europe since its publication in 1996.

The implementation of ISO 9613 in the proprietary noise modelling software enables multiple sound transmission paths, including reflected and screened paths, to be accounted for in the calculated noise levels. The ISO 9613 method predicts noise levels for conditions which favour (i.e. increase) the propagation of noise which the standard defines as light winds wind generally directed from the source to the receiver (wind direction within +/-45 degrees from a line connecting the source to the receiver) or a well-developed moderate ground based thermal inversion.

5.2 Sources and assumptions

The noise modelling has been undertaken for the calculation of average (equivalent) noise levels over a nominal assessment period at surrounding noise sensitive receivers. In lieu of policies for competition motorsport prescribing specific assessment periods, the average noise level is calculated on the assumption of continuous and full usage of the circuits for the duration the assessment period (e.g. 30 minutes, as is relevant to commercial uses of the circuits).

The total noise emission of competition motorsport vehicles is produced by a combination of engine noise, tyre noise and aerodynamic noise. However, at distant receiver locations, the average noise level of motorsport will be dominated by engine noise emissions, due to the relative level and persistence of engine noise throughout a race.

On this basis, and to represent indicative upper noise levels, environmental noise levels have been modelled on the basis that each vehicle on the circuit simultaneously and continuously produces their maximum noise emissions. In practice, the noise emissions of each vehicle will vary significantly at different points around the track. For example, at some points, a vehicle's noise emissions may be slightly higher as a result of the added contribution of tyre noise or interactions with other vehicles. Conversely, vehicles passing through breaking and cornering sections will produce significantly lower average noise emissions while decelerating or maintaining a constant speed. The balance of these effects is that the assumption of constant noise emissions around the track is expected to slightly overestimate the total noise emissions of the circuit. To account for this, the upper predicted noise levels are presented as a range.

In terms of competition motorsport vehicles on the full international circuit, the class of vehicles producing the highest noise emissions (e.g. V8 supercars) has been modelled on the basis of the highest allowable noise levels that the vehicles are able to produce under Confederation of Australian Motor Sport (CAMS) and the International Automobile Federation (FIA). Previous indications for this site were that vehicles may be required to achieve more stringent future standards. However, for the purpose of the current assessment, the modelling has assumed the current standard of 95 dB L_{Amax} at 30 m.

In relation to competition karts, the modelling has been based on measurement data obtained by MDA at other facilities.

These data sources where then used to establish the noise emissions of each vehicle in terms of the sound power level. The sound power level is a description of the total sound energy produced by each vehicle, and is distinct from the sound pressure level which depends on a range of factors such as the distance from the turbine.

A summary of the total sound power levels per vehicle modelled in this assessment is provided in Table 9.

Table 9: Source sound power levels (dB)

	Octave Band Centre Frequency (Hz)							
Source	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**Total**
FIM Grade B / FIA Grade 2 circuit racing	122	126	132	133	127	126	120	134
Go kart (9-16 HP)	121	118	114	117	115	109	107	119

The sound power information per vehicle is then used with the total numbers of vehicles racing in an event to determine the total noise emission of each circuit. This enables the entire circuit path to be modelled as a "line" source of noise to represent an event.

The additional information and input parameters used for the modelling are summarised in Table 10.

Table 10: Model inputs and assumptions

Parameter	Value in model
Source height (vehicles)	
- Race cars	1.0 m
- Go karts	0.5 m
Number of vehicles	
- FIM Grade B / FIA Grade 2 circuit racing	30 cars
- Go kart race	24 karts
- Go kart hire	24 karts
Receiver heights	1.5 m
Ground absorption factors	
- within site boundary	G = 0.0
- wider site area	G = 0.5

5.3 Competition motorsport

5.3.1 Main circuits

The results of the noise modelling for competition use of the full international circuit are presented as a predicted noise contour map in Appendix F1.

A summary of the predicted noise levels is presented below in Table 11 for the nearest existing noise sensitive locations around the development, corresponding to the representative locations where baseline noise monitoring was undertaken.

These predictions do not include mitigation measures and are therefore not intended to represent the level of noise expected to occur in practice. The primary objective of these noise predictions is to identify the extent of further modelling and noise mitigation measures to be investigated as part of subsequent phases of the development's assessment.

Table 11: Full international circuit – competition racing – predicted noise level range without mitigation

ID	Address	Predicted noise level (dB L_{Aeq})
1	245 McGregor Road	65 – 67
2 [1]	317 McGregor Road [1]	69 – 71
3 [1]	30 Greenhills Road [1]	71 – 73
7 [1]	415 McGregor Road [1]	69 – 71
13	255 Watson Road	63 – 65
14	145 Watson Road	61 – 63

Note 1: example dwellings identified, which may no longer be used for residential purposes in future

The results presented in Table 11 are consistent with the inherent high noise level characteristics of competition motorsport.

While there is no applicable policy or guideline in Victoria for the assessment of motorsport noise, the predicted noise levels without mitigation are approaching or above the 65 dB L_{Aeq} design

objective at five (5) of the nearest receivers to the site. These findings confirm that environmental consideration that will need to be addressed in the design and management of the development.

The highest predicted noise levels relate to receiver locations that may not exist, or would cease to be residential in the future, as part of planned development in the surrounding area.

The current expectation is that some of the residences may still be in place when the proposed development commences operation and therefore environmental noise at these locations would need to be addressed for this period. However, the potentially limited time that these receivers would be present after the development commenced operating would be a relevant consideration in determining the appropriate form of reasonable and practical measures to address noise.

The modelling also indicates that predicted noise levels at more distant locations to the north, west and south of the site may need to be addressed and accounted for in any subsequent assessments.

5.3.2 Karting circuit

The results of the noise modelling for competition use of the karting circuit are presented as a predicted noise contour map in Appendix F2.

A summary of predicted noise levels is presented below in Table 12 for the nearest existing noise sensitive locations around the development, corresponding to the representative locations where baseline noise monitoring was undertaken.

As per the predictions for the main circuits, these noise modelling results do not include mitigation measures and are therefore not intended to represent the level of noise expected to occur in practice. The primary objective of these predictions noise levels is to identify the extent of further modelling and noise mitigation measures to be investigated as part of subsequent phases of the development's assessment.

Table 12: Karting circuit – competition racing – predicted noise level range without mitigation

ID	Address	Predicted noise level (dB L_{Aeq})
1	245 McGregor Road	52 – 54
2 [1]	317 McGregor Road [1]	52 – 54
3 [1]	30 Greenhills Road [1]	45 – 47
7 [1]	415 McGregor Road [1]	49 – 51
13	255 Watson Road	46 – 48
14	145 Watson Road	45 – 47

Note 1: example dwellings identified, which may no longer be used for residential purposes in future

The results presented in Table 12 indicate that noise levels associated with competition use of the karting circuit are well below the upper design objective for competition motorsport. However, a noise management plan may still need to consider the types of reasonable and practical measures that can be implemented to reduce the noise levels, including both physical and managerial measures.

5.4 Commercial circuit use

5.4.1 NIRV recommended levels

The noise assessment criteria for commercial uses of the circuits are the recommended levels determined in accordance with NIRV (as described earlier in Section 3.2).

The NIRV recommended levels are presented in Table 13 and are based on the following:

- Receivers 1, 2 and 3: the recommended levels are calculated using the NIRV method for Major Urban Areas on account of being located within the Melbourne Urban Growth Boundary (i.e. SEPP N-1 procedure), and the Urban Grown Zone areas being classified as Type 2 land for the purposes of the calculation
- Receivers 7, 13 and 14: the recommended levels are calculated using the NIRV method for Rural Areas on account of being located outside the Melbourne Urban Growth Boundary
- Background noise levels: the lower background values presented in Section 4.0 are referenced for the calculation. At the location where the survey results indicated an increase in background noise levels during the evening, the lower background noise levels obtained during the day period have been used for the calculation.

Table 13: NIRV recommended levels, dB L_{eff}

ID	Address	Day [1]	Evening [2]
1	245 McGregor Road	57	53
2	317 McGregor Road	55	51
3	30 Greenhills Road	55	51
7	415 McGregor Road	47	44
13	255 Watson Road	47	44
14	145 Watson Road	45	40

Note 1: Day periods for assessment purposes – Monday to Friday 0700-1800 hrs and Saturday 0700-1300 hrs
Note 2: Evening periods for assessment purposes – All days 1800-2200 hrs, Saturday 1300-1800 hrs and Sunday 0700-1800 hrs

5.4.2 Main circuits

Area-wide noise modelling of commercial uses of the main circuits will be undertaken as the proposed operating configuration of the track is developed in further detail as part of the planning application.

In advance of this modelling, the noise level of commercial circuit use relative to competition circuit use is considered in this section.

The noise emissions of commercial uses of the track will vary according to the type of vehicle being used (e.g. test production vehicles versus an experience day using detuned competition vehicles). However, vehicle noise emissions should be significantly lower than that of competition vehicles which utilise the maximum permissible emissions specified under current CAMS and FIA policies. Specifically, based on measurement data obtained by MDA for other types of, individual vehicle emissions are expected to be of the order of 10 to 15 dB lower than that of competition vehicles.

In addition to vehicle emissions, commercial circuit use would generally result in lower noise levels due to fewer vehicles being on the track. For example, reduction of the vehicle numbers from 30 as factored in the competition motorsport noise modelling to 10 to 15 vehicles for commercial use would equate to a reduction of 3 to 5 dB.

The combined effect of these factors equates to commercial use of the main circuit areas being approximately 13 to 20 dB lower than the levels indicated. Estimated noise levels for commercial circuit use are presented in Table 14 by applying these reductions to the competition motorsport levels presented in the preceding section.

Table 14: National & Driver Education Circuits – commercial use – estimated noise level range – no mitigation

ID	Address	Estimated noise level (dB L_{Aeq})	NIRV recommended level	
			Day [1]	Evening [2]
1	245 McGregor Road	45 – 54	57	53
2 [3]	317 McGregor Road [3]	49 – 58	55	51
3 [3]	30 Greenhills Road [3]	51 – 60	55	51
7 [3]	415 McGregor Road [3]	49 – 58	47	44
13	255 Watson Road	43 – 52	47	44
14	145 Watson Road	41 – 50	45	40

Note 1: Day periods for assessment purposes – Monday to Friday 0700-1800 hrs and Saturday 0700-1300 hrs

Note 2: Evening periods for assessment purposes – All days 1800-2200 hrs, Saturday 1300-1800 hrs and Sunday 0700-1800 hrs

Note 3: example dwellings identified, which may no longer be used for residential purposes in future

The results presented in Table 14 illustrate a wide range of estimated noise levels which reflect the potential for significant variations in noise levels depending on the nature of the commercial use. Importantly, the range of levels overlap the range of the day and evening NIRV recommended levels. This indicates that commercial uses can meet the recommended levels, but achieving compliance will require the use of noise mitigation strategies that are tailored to each type of commercial use. For example, depending on the extent of physical measures incorporated into the site layout to reduce the noise of competition use of the main circuit (which would subsequently provide benefits for commercial uses), managerial measures may still be required for some commercial uses (e.g. emission limits for driver experience vehicles).

5.4.3 Karting circuit

Detailed modelling of the commercial uses of the karting circuit will be prepared when the usage pattern and mitigation strategy is developed for the site.

Accordingly, at this stage in the assessment, an appraisal of commercial use of the karting circuit has been carried out in the same manner as presented for commercial uses of the main circuit, Specifically, estimate noise levels ranges are provided for comparison with the NIRV recommended levels by considering the difference in noise levels between competition and commercial use karts.

As with commercial uses of the main circuits, noise emissions of karts used for commercial purposes vary significantly accordingly to the type and configuration of kart used. However, based on measurements conducted by MDA at other sites, the noise emissions of commercial use karts would be at least 10 dB lower than the values accounted for in the competition motorsport modelling.

The number of karts operating in a commercial session will also influence the total average noise levels at noise sensitive receiver locations. However, for the purpose of this stage of this assessment, the estimated level ranges are presented on the basis of the same number of karts assumed in the competition modelling. In practice, kart numbers are expected to be lower for commercial uses and therefore average noise levels would be lower.

Estimated noise levels for commercial kart circuit use are presented in Table 15 by applying the expected 10 dB reduction associated with commercial-use karts to the noise levels presented in the preceding section for competition use of the kart circuit.

Table 15: Karting circuit – commercial use – estimated noise level range – without mitigation

ID	Address	Predicted noise level (dB L_{Aeq})	NIRV recommended level	
			Day [1]	Evening [2]
1	245 McGregor Road	42 – 44	57	53
2 [3]	317 McGregor Road [3]	42 – 44	55	51
3 [3]	30 Greenhills Road [3]	35 – 37	55	51
7 [3]	415 McGregor Road [3]	39 – 41	47	44
13	255 Watson Road	36 – 38	47	44
14	145 Watson Road	35 – 37	45	40

Note 1: Day periods for assessment purposes – Monday to Friday 0700-1800 hrs and Saturday 0700-1300 hrs

Note 2: Evening periods for assessment purposes – All days 1800-2200 hrs, Saturday 1300-1800 hrs and Sunday 0700-1800 hrs

Note 3: example dwellings identified, which may no longer be used for residential purposes in future

The results presented in Table 15 demonstrate that the noise levels of commercial kart operations are expected to comply with the day and evening NIRV recommended levels without any specific noise mitigation measures.

5.5 Noise management

The noise management strategy for the development may include a combination of:

- Engineering measures: these primarily consist of noise barriers formed by site structures and/or dedicated noise berms or walls; and
- Managerial measures: these relate to a range of management mechanisms that relate to how the facility is used.

These measures, and additional measures being considered for the site, are discussed in the following sections. Further information concerning overarching noise management measures for the site are provided in Section 7.0.

5.5.1 Engineering measures

Detailed investigations of engineering measures have been undertaken as part of the preliminary noise modelling for the project. The modelling indicated that the noise reductions associated with typical earth berm heights were relatively limited as a result of a combination of factors:

- Terrain profile: the area is characterised by limited and progressive undulations, however the terrain variations are sufficient to result in some of the nearest receivers being located on higher ground elevations than that of the proposed track layout.
- Separating distances: the expanse of the noise generating areas associated with a motorsport complex (i.e. the length and layout of the track) means that the noise sources are generally located at considerable distances from the boundary locations where engineering measures could be considered.

- Atmospheric conditions: the modelling is based on typical worst-case atmospheric conditions which favour (i.e. increase) the propagation of sound. Accordingly, while a barrier might provide effective reductions under 'neutral' weather conditions, under the atmospheric conditions modelled, barriers placed at intermediate locations between noise sources and receivers provide limited benefits (due to the curved path that sound waves follow under favourable propagation conditions).

These findings indicated that beneficial reductions in noise levels involved screening structures extending to significant heights (typically in excess of 10 m) located as close as practically possible to the tracks. The modelling also showed that the effectiveness of this type of measure was limited to receiver locations that are located on ground elevations comparable to or lower than that of the proposed track layouts.

This is a key consideration for the nearest receivers located to the northeast, east and southeast of the subject site where the predicted noise levels are highest, as some of these receivers are up to 15-17 m higher than that of the proposed track layout. Noise barriers at the perimeter of the site are therefore not a practical or effective method of managing noise levels for these receivers.

Further consultations with the design development team considered options involving noise barriers within the site at locations nearer to the track, and adjacent to sections of the track which contribute most significantly to predicted environmental noise levels. However, these types of barrier configurations introduce significant practical and operational constraints. Further, the cost of this type of management measure is likely to be disproportionate to the limited noise reductions able to be achieved; particularly as a means of reducing noise levels at receiver locations which may only remain in place for a limited time after the development commences operation.

Based on the above considerations, it may be more appropriate in the development context of the site to consider alternative noise management measures for the nearest receiver locations. This could involve the establishment of agreements with the landowners of the nearest noise sensitive receivers to implement offsite noise management measures. This type of approach is typically considered a measure of last resort for the management of noise at permanent receiver locations. However, given the significant land use changes planned in the surrounding area, these types of measures warrant consideration in this instance. The use of these types of agreements would involve consultation with the relevant stakeholders, including residents and the responsible authorities. The types of noise management measures which could be implemented via this type of approach include:

- Interim managerial measures that only apply to overlapping periods after the development commences operation and the receivers remain present
- Noise treatments applied at the receiver locations for the protection of external amenity and/or internal amenity within the dwellings. For example, landscaping and fencing at a property to reduce noise levels in outdoor areas. Alternatively, or in conjunction with external measures, treatments can be applied to the dwellings; this may involve air-conditioning to enable residents to keep windows closed at warmer times of year and sound insulation upgrades for windows, walls and roof structures
- Respite packages which enable a resident to travel at times when the highest noise level events are scheduled.

At other more distant locations around the site, engineering measures may be implemented in the form of noise screening structures along the north, west and south boundaries of the site, comprising a combination of built form (i.e. stands and building structures) and landscaping (i.e. earth berms). As with the investigations outlined above, the noise reductions from these structures may be limited when considering weather conditions which favour sound propagation. However, in other conditions, these types of measures can provide significant reductions, and therefore warrants adaptation of built form and landscaping for noise reduction purposes where feasible to do so. This involves creating linking and/or overlapping forms to provide continuous noise barriers and limit any noise leakage paths that can negate the benefit of otherwise significant structures. For example, linking and extending individual building structures along the southern boundary of the site to form one continuous building structure.

These types of engineering measures should be factored into further detailed modelling conducted as part of subsequent assessment stages for the project.

5.5.2 Managerial measures

The managerial measures used for motorsport may include:

- Limiting the hours when different classes of events can occur
- Defining the maximum number of events to occur per year, and the number of these events which could occur during more sensitive periods (e.g. evenings)
- Limiting the number of consecutive days when high noise level activities occur
- Noise emission restrictions for different vehicle classes
- Enforcement of vehicle noise emission limits via on-site monitoring
- Community consultation and reporting to identify sensitive calendar periods and provide advance notice of upcoming events.

These managerial measures are to be defined in detail as part of planning permit applications. Development of the managerial measures will involve consultation with all relevant stakeholders including local communities and the responsible authorities.

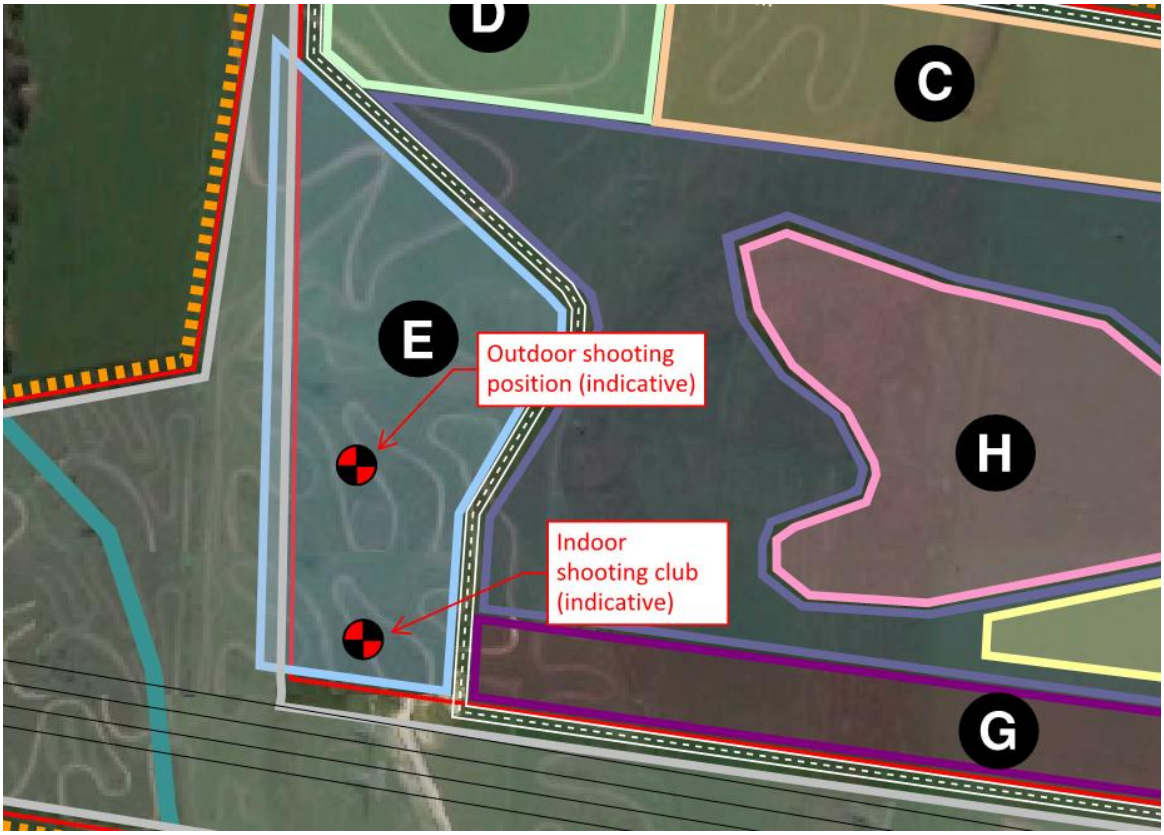
In addition to managerial measures for addressing existing noise sensitive receiver locations, the noise management plan for the development should inform broader land use planning decisions in the surrounding area.

6.0 NOISE ASSESSMENT – OTHER SOURCES

6.1 Shooting range

The indicative indoor and outdoor ranges for the development assumed for this assessment are shown in Figure 7.

Figure 7: Indicative source location (shooting position) at the outdoor shooting range



Details of the proposed hours of operation, types of firearms, numbers and frequency of shooters would be defined as part of any future planning permit application. However, it is understood that the ranges may be used for up to 7 days per week and the outdoor range would primarily be for clay target shooting. For the purposes of the present assessment, noise modelling considers the highest noise levels associated with use of the outdoor range.

Noise levels associated with use of the indoor range are expected be significantly lower, however this would be confirmed in subsequent assessment stages for the selected indoor activity and the proposed building envelope. Separate assessments would also need to be made for any proposals to use the indoor range during the night.

6.1.1 Modelling approach

The preliminary noise modelling for this study has been undertaken to estimate the range of potential noise levels that may occur from the shooting club.

For this purpose, the ISO 9613 model described earlier in Section 5.2 has been used to estimate noise levels. It is noted that gun fire noise propagation is complex, and conventional engineering prediction methods such as ISO 9613 are not intended for modelling this type of noise. However, more detailed modelling methods (such as the ISO 17201[2] procedure for adjusting ISO 9613 calculations) are not widely implemented in industry noise modelling tools. The purpose of this assessment is also primarily directed at assessing the feasibility of the proposed range facilities.

Accordingly, calculations based on ISO 9613 are suitable for providing an indication of outdoor range noise levels. However, subject to the results, and further development of the site layout for the planning application, detailed modelling procedures and adjustments may need to be considered.

Outdoor shooting noise levels were predicted based on the assumed shooting position shown in Figure 7, using noise data measured by MDA at a suburban clay target shooting range. The source levels modelled are:

- Average maximum sound pressure levels of 103 dB L_{AImax} at 10 metres
- Highest maximum sound pressure levels of 109 dB L_{AImax} at 10 metres

Sources have been assumed omnidirectional at this stage (i.e. noise propagates equally in all directions while, in practice, noise levels would be lower behind the firing direction).

6.1.2 Results

The estimated noise levels from the outdoor shooting range at the nearest receivers are presented in Table 16 with the target noise levels determined in accordance with EPA Publication 1508. The target noise levels represent the recommended threshold above which limitations on how many days per week a facility operates should be considered.

Table 16: Outdoor shooting range noise assessment – estimated noise levels without mitigation

ID	Receiver	Predicted avg. max. dB L_{AImax}	Target level – day (BG + 10)	Target level – evening (BG + 5)	Potential limitations required?
1	245 McGregor Rd	48	55	42	Evening
2	317 McGregor Rd	45	51	48	-
3	30 Greenhills Rd	43	50	52	-
7	415 McGregor Rd	45	49	50	-
13	255 Watson Rd	44	49	47	-
14	145 Watson Rd	46	44	40	Day and evening

Note: Target noise levels are based on the 10th percentile L_{A90} values

[2] ISO 17201:2010: *Acoustics — Noise from shooting ranges — Part 3: Guidelines for sound propagation calculations*

The estimated noise levels without noise mitigation measures indicate the following:

- The noise level at Receiver 14 is predicted to be 2 dB above the daytime target level
- The noise levels at Receivers 1 and 14 are predicted to exceed the evening target levels by 6 dB.

Based on the outcomes of this high-level assessment, the outdoor shooting range appears feasible for the site on the basis that the following measures could be implemented:

- Engineering measures: barriers, orienting shooters away from sensitive receivers; and/or
- Managerial measures: restrictions on how many days and evenings per week the outdoor range operates.

Further assessments should be undertaken as part of the detailed design to determine suitable engineering and managerial measures to address noise from the site.

The noise of the outdoor shooting range should also be accounted for in the design of other buildings on the site containing noise sensitive uses (e.g. commercial and proposed hotel spaces).

Similarly, the indoor shooting range will need to be designed to reduce internal noise levels, as well as environmental noise breakout.

6.2 Helicopters

A helipad may be used for medical emergencies and for VIP/corporate movements associated with major race events, corporate events or other private uses of the circuit.

The EPA Publication 1254 guidance for helicopter movements would only apply to private/commercial movements to and from the site; the criteria would therefore not apply to medical emergencies.

Details of potential helicopter types and flight paths expected to be defined during subsequent stages of the project. The selection of helipad location and proposed flight paths would account for a range of safety and environmental considerations including noise. In relation to noise, the objective would be to locate the helipad and typical movements paths at more than 150 m to 250 m from the nearest receivers; the separating distances noted in EPA Publication 1254 as typically being sufficient to meet the noise criteria.

Experience of noise modelling helicopter movements from private landing sites confirms that these criteria can usually be met with these separating distances, however compliance is ultimately dependent on the type of helicopter flown and the proposed flight paths to the site. Accordingly, as this information becomes available, noise levels should be reviewed to demonstrate compliance with the criteria.

Any procedures that may be required for reducing the noise impacts of helicopter operations to and from the site should be determined as part of any relevant planning permit application and, if required, would need to be documented as part of the overall noise management plan.

6.3 Concerts

The applicable noise criteria for outdoor concerts at the site are provided by SEPP N-2. Compliance with SEPP N-2 is mandatory.

Preliminary noise modelling has been undertaken on the basis of a high noise level rock concert being held at a central location within the subject site.

The results indicate that the 65 dB L_{Aeq} criterion specified in SEPP N-2 is expected to be achievable. However, the event restrictions noted in SEPP N-2 are expected to be applicable for the highest noise level events.

Measures for the management of outdoor concert noise may include:

- Siting and orientation of the stages
- Restrictions on event times
- Defining limits to be met at front of stage locations that correspond to compliance at noise sensitive receiver locations.

Potential future uses of the site may seek approval of the responsible authority to host more than six (6) events per year. Such proposals would be subject to the application procedures detailed in SEPP N-2.

The mitigation strategies used to manage outdoor concert noise would be reviewed as part of any relevant planning permit applications for the site and should be documented as part of the overall noise management plan. Any noise management plan should also include the procedures that would apply in any instances where more than six (6) concerts are proposed in a given year.

6.4 Public Address System Noise

Noise from public address (PA) systems has not been assessed at this stage. It is expected that the PA coverage required at the facility will vary significantly from event to event. Some areas are likely to require permanent PA systems (e.g. go kart track, permanent grandstands, pit areas, etc.), whilst temporary systems are expected to be brought in for larger infrequent events.

All PA systems used at the venue should be designed to meet the targets outlined in EPA Publication 1254. The necessary setup and operational measures for both permanent and temporary systems should be developed for each relevant planning permit application, with requirements specified in any noise management plan.

7.0 NOISE MANAGEMENT PLAN

The assessments presented in the preceding sections identify proposals for further noise assessments as part of any future planning permit applications and subsequent design development of the site. Further, the review has identified that addressing noise levels associated with the range of potential uses at the site is expected to involve a combination of engineering and managerial measures.

The suite of measures developed during subsequent assessment stages should be documented in a noise management plan, which would form part of the overall environmental management plan for the site.

The key information which should be detailed in a noise management plan includes:

- Description of all noise sensitive locations that the noise management plan is designed to protect, including any location-specific considerations (e.g. agreements)
- Description of the activities permitted and any applicable exclusions
- Permitted hours of operation for each respective activity
- Permitted frequency of events, particularly for high noise level events
- Details of when and the manner in which notice of certain events are to be published or distributed to members of the public
- Maximum permissible noise levels and methods of monitoring compliance (where relevant)
- Details of measures to be implemented to manage noise
- Identification of individuals responsible for the management and implementation of the noise management plan
- A complaint response procedure
- Details of any planned or periodic noise management plan reviews.

The development context to the site is a key consideration for the noise management plan. In particular, planned changes of land use in the surrounding area are expected to involve a reduction in the number of sensitive receiver locations near to the site. Longer term background noise levels in the area are also likely to change as a result of the introduction of new road traffic routes. For these reasons, the processes for implementing the noise management plan should allow the flexibility for the plan to be adapted and updated in line with changes to the land use of the surrounding areas. This could involve the use of conditions in any planning permit, which require:

- A noise management plan to be submitted and approved by the responsible authority prior to commencement or development of the use;
- Periodic review and evaluation of the effectiveness of the noise management plan;
- Any proposed variations to the noise management plan to be approved by the responsible authority.

8.0 CONCLUSION

Podium 1 Pty Ltd (Podium 1) are proposing to develop the Cardinia Motor Recreation & Education Complex on land located at 21 Key Lane, 75 Key Lane, 115 Key Lane and 335 McGregor Road Pakenham.

A high-level review of noise considerations has been undertaken for the purpose of the Development Plan submission. Separate noise assessments should be undertaken as part of any subsequent Planning Permit applications.

The review has primarily considered the development of a new motorsport recreation and complex at the subject site. The broader uses of the subject site are anticipated to involve relocation of club motorsport activities which currently occur on and around the subject site to other parts of the subject site. While no specific assessment of these existing activities has been undertaken as part of this review, the assessment principles outlined in this review would apply equally to the relocated uses at the site. Further, if and when a planning permit application is lodged to relocate these activities, it is recommended that these applications include an acoustic assessment, and that the assessments are conducted on a cumulative basis in order to account for the overall motorsport noise of the subject site.

The key source of noise associated with the motor recreation and education complex is expected to be competition motorsport on the main circuits and karting circuit. In Victoria, there are no policies or guidelines which set mandatory requirements or noise limits for competition motorsport noise. In lieu of such policies, noise from these types of facilities is usually managed using mitigation strategies that are tailored to the context of each facility.

Competition motorsport is an inherently high noise level activity. This is reflected in the results of preliminary noise modelling for the site which indicates that mitigation strategies should be implemented to manage motorsport noise associated with the development and use of the site. These mitigation strategies should be implemented to address noise levels at the nearest receivers, as well as distant receivers located to the north, west and south the subject site.

A key point of context is that the land is zoned SUZ5 which promotes the development of a motor recreation and education facilities and the surrounding areas are proposed to undergo significant changes in the future. These are expected to include the construction of new arterial roads and the creation of employment precincts to the west, north and east. In particular, it is understood that these changes will mean that some of the nearest properties to the site will no longer be used for residential purposes. Development of new precincts around the site are also focussed on employment uses and additional sensitive receivers are therefore considered unlikely (any planning applications for new noise sensitive locations would also need to account for the noise of the motorsport uses that are promoted for the site).

For these reasons, the strategy to manage competition motor sport noise is proposed to include interim measures for the nearest receiver locations which are expected to undergo a change of land use in the future. The purpose of these interim measures would be to address noise levels during any overlapping period in which the development is operational while the nearest receiver locations remain in place. Interim measures may involve a range of strategies, such as localised noise treatments at residential properties and additional restrictions on events that can be held while the uses of the surrounding area are in transition. The use of interim measures would involve consultation and agreements with relevant stakeholders including landowner and the responsible authorities.

Managing the noise of competition motorsport is also expected to include:

- Engineering measures in the form of noise barriers where effective reductions can be achieved with reasonable and practical structures; and/or
- Managerial measures such as restrictions on hours of operation, limits on the number of events which occur during the year, scheduling restrictions, vehicle noise emission limits and ongoing community consultation.

Commercial uses of the circuits will also need to be addressed as part of any subsequent planning permit applications, with outcomes documented in a noise management plan for the site. It is noted that noise associated with commercial uses of the main circuits and karting circuit (e.g. driver education, kart hire, driver experience days and corporate events) is assessable under Victorian EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV). Preliminary noise assessments indicate that the recommended levels can be met, provided that the broader engineering measures for competition motorsport are supplemented with dedicated managerial measures for each type of commercial use proposed.

The suite of measures that are used to address the range of potential uses at the site are proposed to be documented in a noise management plan which would form part of the overall environmental management plan for the site. Recognising the planned developments in area around the site, the processes for implementing the noise management plan should allow the flexibility for the plan to be adapted and updated in line with changes to the land use of the surrounding areas.

The engineering and managerial measures for competition and commercial motorsport noise are to be developed in detail during subsequent assessment stages for the project. This will involve consultations with relevant stakeholders and detailed assessments for the range of motorsport proposed at the site. These assessments will need to consider the noise associated with each category of motorsport proposed at the site in order to inform the number and type events that can be accommodated.

In addition to motorsport, other key sources of noise associated with the motor recreation and education complex are the proposed shooting ranges (indoor and outdoor ranges), outdoor concerts and a helipad. Details of relevant polices and guidelines have been outlined in this report. Preliminary assessments indicate that the noise of these sources can be managed to comply with the applicable criteria. As with the motorsport project, the specific measures to be used to manage noise should be addressed as part of any relevant planning permit applications and subsequent assessments.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the frequency response of the human ear.
dB	Decibel The unit of sound level.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Vibration can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. The frequency of vibration and sound is measured in hertz (Hz). Once hertz is one cycle per second.
L_{A90}	The A-weighted noise level equalled or exceeded for 90 % of the measurement period. This is commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L_{eff}	The effective noise level of commercial or industrial noise determined in accordance with *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1). This is the L_{Aeq} noise level over a half-hour period, adjusted for the character of the noise. Adjustments are made for tonality, intermittency and impulsiveness.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
L_{AImax}	The maximum A-weighted noise level measured using the Impulse time weighting.

APPENDIX B MOTORSPORT NOISE GUIDANCE AND PUBLICATIONS

Set out below is a summary of existing motor sports noise regulations, policies and guidelines in place in Australia.

B1 Victorian EPA discussion paper

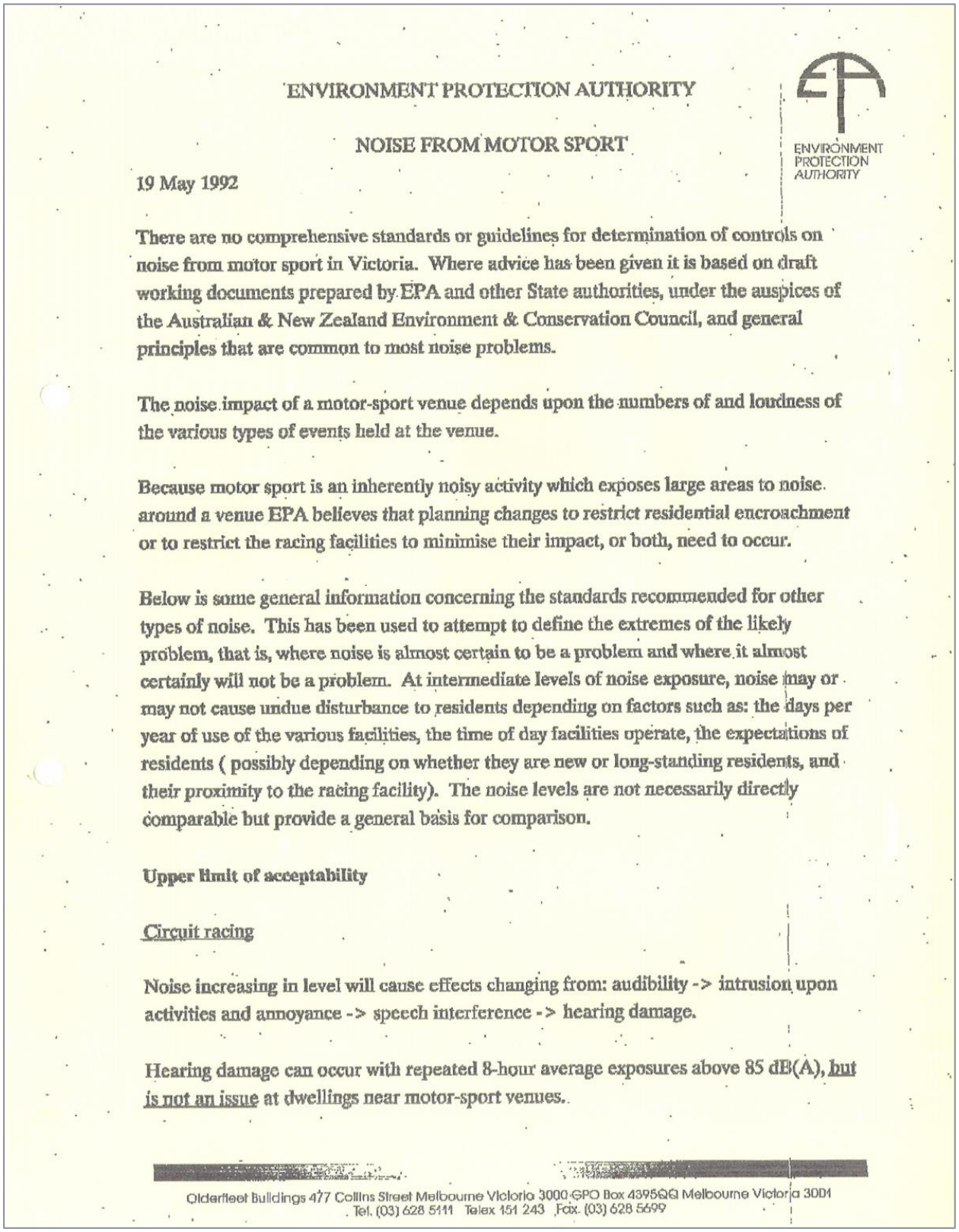
A discussion paper was prepared by the EPA Victoria in 1992 for a planning matter regarding Winton Raceway near Wangaratta in central Victoria. Although it is not an official Victorian EPA guideline, it does provide some guidance on the range of noise limits which may be considered for a motorsport venue.

Using various standards and policies relating to traffic noise as a guide, the discussion paper concludes that the maximum acceptable noise level for circuit racing during the day should be approximately 65 dB L_{Aeq} outdoors. For events during the day time, a noise level of 50 dB L_{Aeq} was considered to be '*unlikely to cause significant noise intrusion on residents'*.

In regard to drag racing noise, comparisons are made with aircraft noise, noting that there are differences in frequency, intensity and the nature of aircraft noise and drag racing noise. The EPA discussion paper concludes the maximum acceptable noise level for circuit racing should be approximately 80 dB L_{Amax} outdoors; however, the suitability of this will depend on *"the number of operations of the drag strip, loudness of other events (circuit racing, etc.), and the attitude and expectations of residents"*.

The EPA discussion paper is reproduced in Figure 8 to Figure 11 on the following pages.

Figure 8: Victorian EPA discussion paper – page 1



ENVIRONMENT PROTECTION AUTHORITY

NOISE FROM MOTOR SPORT

ENVIRONMENT PROTECTION AUTHORITY

19 May 1992

There are no comprehensive standards or guidelines for determination of controls on noise from motor sport in Victoria. Where advice has been given it is based on draft working documents prepared by EPA and other State authorities, under the auspices of the Australian & New Zealand Environment & Conservation Council, and general principles that are common to most noise problems.

The noise impact of a motor-sport venue depends upon the numbers of and loudness of the various types of events held at the venue.

Because motor sport is an inherently noisy activity which exposes large areas to noise around a venue EPA believes that planning changes to restrict residential encroachment or to restrict the racing facilities to minimise their impact, or both, need to occur.

Below is some general information concerning the standards recommended for other types of noise. This has been used to attempt to define the extremes of the likely problem, that is, where noise is almost certain to be a problem and where it almost certainly will not be a problem. At intermediate levels of noise exposure, noise may or may not cause undue disturbance to residents depending on factors such as: the days per year of use of the various facilities, the time of day facilities operate, the expectations of residents (possibly depending on whether they are new or long-standing residents, and their proximity to the racing facility). The noise levels are not necessarily directly comparable but provide a general basis for comparison.

Upper limit of acceptability

Circuit racing

Noise increasing in level will cause effects changing from: audibility -> intrusion upon activities and annoyance -> speech interference -> hearing damage.

Hearing damage can occur with repeated 8-hour average exposures above 85 dB(A), but is not an issue at dwellings near motor-sport venues.

Olderfleet Buildings 477 Collins Street Melbourne Victoria 3000 GPO Box 4395QQ Melbourne Victoria 3001
Tel. (03) 628 5111 Telex 151 243 Fax. (03) 628 5699

Figure 9: Victorian EPA discussion paper – page 2

Speech interference (interference with talker/listener communication) will occur at noise levels that depend on the distance between talker and listener. At approximately 1-2 metres noise levels of 60 - 65 dB(A) will cause difficulty in speech communication. These noise levels give a guide to the upper level of acceptability for outdoor amenity during the day time (circuit racing).

For noise from traffic, VicRoads in recent times has designed road alignments and barriers to meet 63 dB(A) outside affected dwellings. In the United Kingdom traffic noise exceeding 68 dB(A) is the point at which affected residents may be given financial compensation.

Australian Standard AS 3671-1989 Road Traffic Noise Intrusion - Building Siting and Construction recommends (in effect) that special construction of dwellings be employed and windows remain closed when traffic noise levels exceed 60 dB(A) outside the dwelling.

The highest noise limit set by *State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No N-1* is 68 dB(A) for the day period for a house surrounded totally by general industrial uses and with background sound levels no lower than 55 dB(A).

EPA considers that the comparisons above indicate that the maximum acceptable noise level for daytime circuit racing should be approximately 65 dB(A) outdoors. This maximum level should approximately indicate the noise level contour inside which dwellings should not be constructed, subject also to the maximum limit for other types of racing.

Drag racing

Drag racing is loud, but with each event short in duration.
To estimate the maximum likely acceptable noise level for drag racing, a comparison is made with standards recommending maximum noise levels for aircraft and helicopter noise which have some similarity to drag racing in the quality and nature of the noise. The standards also specify average noise levels to be met as well as the peak level.

Australian Standard AS 2363-1990 Assessment of Noise from Helicopter Landing Sites in giving guidance for planning purposes says that a maximum helicopter noise level of 80 dB(A) for the night period (7 pm - 7 am) should be met outside any dwelling.

Figure 10: Victorian EPA discussion paper – page 3

Australian Standard AS 2102 -1985 Aircraft Noise Intrusion - Building Siting and Construction recommends that in the absence of full flight data that for more than 20 flights per day, a noise level of 85 dB(A) for houses will be unacceptable and construction should not normally be considered.

EPA considers that given the above and the differences in frequency, intensity and nature of aircraft noise and drag racing noise the maximum acceptable level for drag racing noise should be approximately 80 dB(A).

Again this should be seen as the noise contour inside which dwellings should not be permitted. Below this level noise may be unacceptable depending on the number of operations of the drag strip, loudness of other events (circuit racing etc), and the attitude and expectations of residents.

Lower limit for acceptability

For frequent circuit racing during the day a noise level of approximately 50 dB(A) is unlikely to cause significant intrusion upon residents. This is consistent with the SEPP N-1 industrial-noise normal day time limit of 50 dB(A) for a completely residential or rural area.

For the evening drag racing, the lower limit of acceptability is not certain.

Australian Standard AS 2102 -1985 Aircraft Noise Intrusion - Building Siting and Construction recommends for aircraft noise that three regions be considered: an "Acceptable" region; a "Conditional" region, where noise is possibly unacceptable and building construction may need consideration, and "Unacceptable" zone where housing construction should not normally be considered.

Figure 11: Victorian EPA discussion paper – page 4

Using a similar concept the following three regions are recommended:

Inner region	>65 dB(A) circuit racing \ dwellings should or >80 dB(A) drag racing / not be permitted
Central region	circuit racing 50 dB(A) to circuit racing 65 dB(A) (or peak drag racing 80 dB(A)).
Outer region	circuit racing < 50 dB(A) (outer limit of drag racing acceptability uncertain)

In the broad central region from 50 dB(A) to 65 dB(A) (or 80 dB(A) for drag racing) noise may affect amenity depending on the various factors mentioned earlier. Depending on the location in this region, special attention to housing construction may be needed to preserve the inside amenity of the home. Amenity outdoors may be unacceptable. EPA recommends that planning changes in this central region should occur to minimise the loss of amenity including restrictions on the type of dwellings allowed.

B2 Victorian case study: Calder Park Raceway

The Calder Park Raceway began as a single circuit in 1962, developing into what is now a complex of motor sport tracks, including a dragway. It is located in the City of Brimbank, north-west of Melbourne, in an area that was formerly rural but has been slowly encroached upon by outer suburban developments. As such, it is an example of how noise from a well-established existing venue can be managed. Ambient noise levels are quite high, as the raceway is next to the Calder Highway and is sometimes affected by aircraft noise.

The nearest suburb currently affected by noise from Calder Park is to the south at a distance of approximately 500 m.

The nearest affected residential property is the Whittle residence, located on land zoned for rural use adjacent to the Calder Freeway at a distance of approximately 100 m from the Calder Park Raceway property boundary and approximately 200 m from the National Circuit race track. The Organ Pipes National Park Visitor Centre is located approximately 600 m north-east of Calder Park.

The Calder Park motor sports complex operates up to seven days per week and hosts a variety of events including drag racing, circuit racing, speedway, racing practice and various car club meetings.

Noise barriers in the form of spectator stands, earth mounds, concrete retaining walls and combinations of all three shield most of the adjacent area from noise. These barriers are up to 20 m in height.

In order to manage development of the Calder Park site, including noise levels, Brimbank City Council issued an amended planning permit in July 2004. This permit states that:

- All events must be of no more than one day's duration, except for one three-day race event and one three-day concert
- There must be no more than three major events during any calendar month between 15 October and 15 April (the racing season) with a maximum of 18 events
- There must be no more than two events during any calendar month between 15 October and 15 April involving jet-powered vehicles, nitro-burning vehicles or formula one vehicles
- There must be no more than one major event during any calendar month between 16 April and 14 October
- There must be no more than 24 events in any calendar year, of which no more than 6 can be concerts and no more than 12 can be events involving jet-powered vehicles, nitro-burning vehicles or formula one vehicles
- Motor sport events can only take place between 0900 and 1900 hrs except on Friday, Saturday and one Sunday per calendar month, when racing can be extended to 2300 hrs. However, racing can only be extended on one night per month during the non-racing season.

With regard to drag racing, a major event is defined as any event where there are Group 1 vehicles competing.

Noise limits for residential land are specified for motor sport events. These are reproduced in Table 17.

Table 17: Noise limits for motor sport events at Calder Park Raceway

	Day (0900 to 1800 hrs)	Evening (1800 to 2300 hrs)
In a no wind situation at the boundary of any residentially zoned land	65 dB L_{Aeq}	60 dB L_{Aeq}
In a situation where the wind is blowing from the direction of the raceway towards the residentially zoned land at the boundary of such residentially zoned land	75 dB L_{Aeq}	70 dB L_{Aeq}

These criteria are the same as in an earlier planning permit, dated 1984. Events involving jet-powered vehicles, nitro-burning vehicles or formula one vehicles are exempted from these criteria.

Noise limits for the Organ Pipes Visitor Centre are determined by measuring the noise levels at the Centre, and then setting the limits equal to the measured noise level. However, it appears there is scope for even these limits to be exceeded under some circumstances.

Noise limits are not specified for other noise-sensitive premises, such as residences built on land zoned rural (e.g. the Whittle property).

The permit conditions specify that compliance measurements must be undertaken within three months of the permit taking effect, and then in response to complaints.

B3 Australian Capital Territory

The ACT publication *Motor Sports Noise Environment Protection Policy* 2002 was developed to address noise from existing motorsport facilities; specifically, facilities referred to as the Fairburn Park Cluster and Stromlo Forest.

Noise level criteria

The policy sets motor sports noise criteria in terms of the Zone Noise Standards specified in the Noise Environment Protection Policy, but allows a limited number of exceedances of the criteria through a system of "event credits". No event may exceed 65 dB at the compliance location.

Zone Noise Standards are expressed in terms of $L_{A10,T}$. However, the time base T is not clearly defined.

The compliance location is the location at which noise from an activity must not be excessive. This location is established for each facility, in or near to the existing residential areas most affected by the noise.

Number of events each year

Each existing facility is allotted a number of annual event credits. Each facility's noise levels are monitored and compared to the Zone Noise Standard at the compliance location.

The scale is linear, with every 2.5 dB of excess of the Zone Standard incurring 0.5 event credits. As discussed subsequently in this Appendix, an approach to managing event numbers according to noise level ranges is outlined in an example provided for local councils in NSW.

Time at which event takes place

Both daytime (0900 – 1700 hrs) and evening (1700 – 2200 hrs) events are permitted. Events commencing before 1700 hrs and continuing after 1700 hrs are treated as though they are two events unless the event duration is less than 5 hours total. The Fairbairn Park cluster of facilities is subject to a particular restriction whereby events may only be held between 0900 and 1700 hrs.

Spread of events during the year

The policy sets limits on the occurrence of events in order to ensure a reasonable spread. Events may not be held on more than 2 consecutive days, more than 2 consecutive weekends or more than 2 weekends in any month.

Prior notification

The policy provides detailed requirements for public notification of motor sports events, recognizing that advance warning of events *"assists residents affected by noise from motor sports to organise their activities to minimise the adverse impact of that noise."*

Demonstrating compliance

Facilities are required to demonstrate that motor sports activities comply with their operational conditions by noise monitoring. Monitoring must occur at the compliance location, or if demonstrated to be representative, trackside monitoring is permissible.

B4 NSW EPA Noise Guide for Local Government

This NSW Noise Guide for Local Government (the NSW Guide) aims to provide practical guidance to council officers in the day-to-day management of local noise problems and in the interpretation of NSW policy and legislation.

The document notes that the guidance is advisory in nature, and council officers are encouraged to use it to develop council procedures or policy to deal with noise issues relevant to local circumstances. This is an important point of context when referring to NSW guidance for Victorian developments, and when considering projects of varying size, scale and local planning merit.

The NSW Guide provides case studies to describe typical situations and show examples of how assessment, management and regulatory tools can be used to help control common noise problems.

Case study 2 describes an example of how noise from a motor sporting event can be managed. The case study also provides an example of how noise from venues that accommodate several different event types can be managed so that there is an overall cap on the noise from all events over a specific time period.

The NSW case study is reproduced in Figure 12 to Figure 14 on the following pages.

Figure 12: NSW Guide extract – Case Study 2 (part 1)

Case study 2: Noise from a motor sport facility

Council received inquiries about a proposal to establish a motor racing facility, which would involve drag racing and circuit racing. Council advised that any proposal for such a facility would require a noise assessment predicting noise impact from the proposed development. Council further advised that the noise assessment should be undertaken in two stages. The first stage would focus on site planning, thereby providing input into the facility location, siting and orientation. The second stage would address operational noise impacts.

In this scenario the noise assessment should assess:

- the sound power level of the different types of racing vehicle
- the number and type of events planned for the facility (e.g. drag racing, motocross, circuit racing, speedway or go-karts)
- the number and location of racing cars on the circuit and in any pit or warm-up areas
- potential meteorological effects on noise propagation and impacts in the surrounding area (the *NSW Industrial Noise Policy* (EPA 2000) provides guidance on this aspect).

The noise assessment should also identify the vehicle numbers on the track and their configuration with the potential to cause maximum noise impact. Noise modelling that is applied to each proposal should be compared with actual measurements that would serve to validate the model for this use.

Council also asked that the noise assessment provide noise mitigation strategies for the facility as well as predicted noise level reductions. Council expected that such an assessment would discuss the feasibility of the following noise mitigation and management options.

On-site noise mitigation

- Orient the track to use existing topography to reduce noise at noise-sensitive receivers.
- Locate very noisy racing track types (e.g. drag racing) furthest from noise-sensitive receivers and orient them to minimise noise.
- Use earth mounds and barriers.

Noise source controls

- Use effective mufflers on racing vehicles and require all vehicles to meet Confederation of Australian Motor Sport noise specifications.
- Implement a program for testing the noise of racing vehicles to ensure they meet racing association noise limits.

Operational noise controls

- Restrict times for practice and race days.
- Use respite periods during the racing schedule of an event.
- Limit of the number and type of events.

Figure 13: NSW Guide extract – Case Study 2 (continued – part 2)

Receiver noise controls

In extreme situations and as a last resort, council could consider attaching development consent conditions requiring the proponent to implement noise controls at receiver locations such as:

- noise insulation for nearby houses
- where noise impacts are totally unacceptable, and the facility continues to operate, the proponent offering to acquire nearby property.

Legal advice should be sought if these types of condition are proposed.

Operational noise management plan

In addition to implementing many of the noise mitigation strategies mentioned above, council decided to ask the motor racing organisation to develop an ongoing noise management plan for events at the proposed facility. This noise management plan was included as a development consent condition, providing clear requirements for noise from the site and enabling council to regulate the operation of the facility. The noise management plan identified the number of events that would be allowed to occur at the facility, the noise monitoring program and the operator's complaint management system.

The event schedule (Table 3.1) for the motor racing facility was based on achieving a balance between how loud different racing events were likely to be and how often they occur. In this way council felt there was some control over the amount of noise nearby residents would be exposed to.

Using this approach, council decided that the maximum number of events that would be permitted in any 12-month period would be 50 with noise of background plus 5 dB. Where some events were likely to be noisier than this, then the number of events would reduce according to a ratio shown in Figure 3.4. The graph allows for an event multiplication factor to be assigned where noise from the event exceeds background plus 5 dB(A). For example, an event that exceeded the background by 8 dB(A) would count as two events, as the multiplication factor from Figure 3.4 is 2. The determination of an equivalent number of events from the graph was a way of capping the total amount of noise that adjacent residents would be exposed to over a year.

Differences between impacts from new versus existing facilities

The community is generally more sensitive to a new source of noise (e.g. from a new sporting facility at a greenfield site) than from existing facilities at the same noise level. This means that the same noise impact on the community from a new facility compared with an existing facility would occur only if the activity levels at the new facility were lower. In this case the proposal is for a new development. Therefore the number of events allowed for this new facility may be less than council might have approved for an existing facility of comparable size and proximity to residences.

The noise assessment report provided details of the expected noise levels from each type of racing event and how much the background noise level was likely to be exceeded. The noise impacts of drag racing in particular appeared to contribute a disproportionate amount to the 50 equivalent events allowed. Council suggested that the event schedule for the coming year be amended to include one drag racing event each year instead of the two proposed. This meant that the whole event schedule would not exceed the maximum of 50 equivalent events over the year. The type and number of events were included in the noise management plan.

The assessment noted that most racing events were held between 9 am and 5 pm, and up to ten late-night events up to 10 pm would be held each year. These operating times were also included in the proponent's noise management plan.

Figure 14: NSW Guide extract – Case Study 2 (continued – part 3)

Council decided that a condition of development consent would be:

> *that the type, timing and number of events would be as specified in the facility's operational noise management plan approved as part of the application, and that these could be varied only following agreement by council.*

This condition provided certainty to the operator and the local community while allowing some flexibility.

For existing motor sport facilities, where council is the ARA, council could regulate the activity under the POEO Act using a Noise Control Notice or a Prevention Notice to limit times of operation, noise levels and the way the activity is carried out.

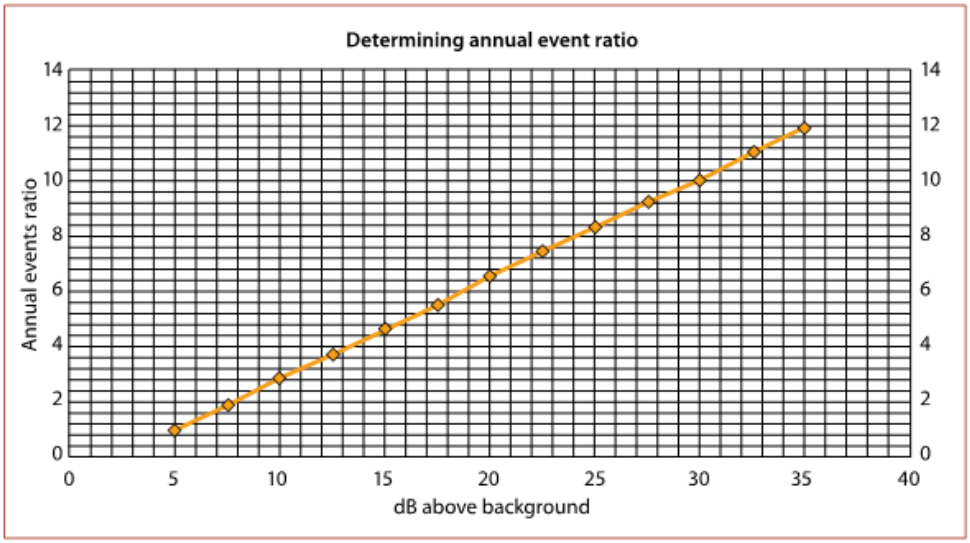
A similar approach, balancing noise level against noise exposure, can be taken for other event-based activities such as target shooting ranges and lawful sporting events at specific sites.

Table 3.1: Motor sport event schedule

Event description	Exceeds background by up to	Proposed no. of events x event multiplication ratio (from graph)	Equivalent no. of events	Amended equivalent events	Permitted no. of events
Super tourers	20 dB	3 x 6	18	18	3
Drag racing	30 dB	2 x10	20	10	1
Vintage series	10 dB	3 x 3	9	9	3
250/500 cc motorcycles	18 dB	2 x 6	12	12	2
Proposed number of events				49	9
Total equivalent events allowed				**50**	

Note: The background noise level in this example is assessed in accordance with the *NSW Industrial Noise Policy* and the emergence above background noise should be assessed using an $L_{Aeq(15min)}$.

Figure 3.4: Graph for determining event multiplication ratio from noise level



Part 3: Noise management principles 3.29

B5 Queensland

Planning for Shooting and Motor Sport Facilities (2014) is a planning guideline prepared by the Queensland Department of National Parks, Sport and Racing, which is describes its intentions as being to:

> *…assist in minimising the risk of conflict between these sport and recreation activities and sensitive land uses*

The guide provides a discussion of the complicating factors relating to noise nuisance and separating distances, and that noise must be assessed on a case by case basis. The discussion of considerations relating to separating distances concludes with the following notes:

> *Experience in Queensland has demonstrated that poor outcomes are likely when noisy sport and recreation facilities and sensitive land uses are developed in close proximity, however, it is not feasible to prescribe or defend a specific separation distance.*
>
> *Where this guideline refers to separation distances between land uses these should be interpreted as suggestions or recommendations only, proposed to trigger consideration of the value of acoustic assessments to reduce the risks of conflict between land uses.*

The guide subsequently presents the following in relation to motorsport noise:

> ***As a guide, NSPR recommends that:***
>
> - *sensitive land uses and motor sport facilities are separated by a minimum distance of 2 kilometres, or*
> - *where a proposal suggests a smaller separation than this, an independent acoustic assessment is undertaken by a qualified acoustics engineer to assess whether and how the acoustic quality objectives in Schedule 1 to the Environmental Protection (Noise) Policy 2008 can be met at sensitive receptors.*

The 2 km separation distance is based on an meeting a level of 45 dB L_{Aeq} for an example off-road motorcycling facility with 30 motorbikes being ridden concurrently "on open flat land, or where there is a line-of-sight to a noise receptor".

The second element of the recommendation allows for a more detailed approach to be adopted with reference to the 'acoustic quality objectives' in Schedule 1 to the *Environmental Protection (Noise) Policy 2008*. As an example, an 'acoustic quality objective' of 50 dB $L_{Aeq,adj,1hr}$ applies to dwellings (outdoors) during daytime and evening hours.

The noise criteria outlined in these examples and recommendations represent very stringent criteria for a major motorsport facility in an urban environment, and would generally not be achievable with the separating distance noted.

As an additional point of context, the Queensland *Environmental Protection Act 1994* (EP Act) specifies provisions for higher noise emissions associated with open-air events which have been applied to established motorsport sites. An extract from the EP Act is shown in Figure 15.

Figure 15: Environmental Protection Act 1994 extract

440X Open-air events

(1) An occupier of premises must not use, or permit the use of, the premises for an open-air event on any day—

(a) before 7a.m, if the use causes audible noise; or

(b) from 7a.m. to 10p.m, if the use causes noise of more than 70dB(A); or

(c) from 10p.m. to midnight, if the use causes noise of more than the lesser of the following—

(i) 50dB(A);

(ii) 10dB(A) above the background level.

(2) However, subsection (1) does not apply to licensed premises.

(3) Also, subsection (1)(b) does not apply if—

(a) the premises is, or is part of, an educational institution; and

(b) the use of the premises for an open-air event is organised by or for the educational institution for non-commercial purposes of the institution.

The noise metrics stated in the EP Act were clarified to be $L_{eq,T}$ by the Queensland Ombudsman in a report on the Lakeside Park Raceway[3]. The time period, T, is defined as "an interval of at least 15 minutes or, if the noise continues for less than 15 minutes, the duration of the source noise" (i.e. the duration of a race).

[3] *The Lakeside Noise Report: An investigation of action taken by Moreton Bay Regional Council to regulate noise emissions from Lakeside Motor Racing Circuit*, Queensland Ombudsman, November 2015

B6 Western Australia

Division 3 of the *Environmental Protection (Noise) Regulations 1997* provides an 'opt in' approvals process that allows noise levels to exceed the 'assigned noise levels' in the Regulations provided motor racing activities in motor sport venues are carried out in accordance with an approved noise management plan for that venue.

The Department of Environment Regulation[4] publication *Guide to Management of Noise from Motor Sport Venues* (July 2014) describes the approach as follows:

> *Where a motorsport venue cannot practicably comply with the assigned noise levels, Division 3 of the Regulations allows the venue occupier to apply for a special approval. Under this approval the noise emissions from the venue are permitted to exceed the assigned levels in the Regulations provided the venue operates in accordance with an approved noise management plan (NMP) for the venue.*

The guideline also describes the approvals and appeals process, noting that:

> *In the vast majority of cases these approvals are to be granted by local government chief executive officers acting under delegation, the intention being that these decisions will be made at the local level.*

[4] Now called the 'Department of Water and Environmental Regulation'

APPENDIX C VICTORIAN EPA PUBLICATION 1254 – PA SYSTEM GUIDANCE

EPA Publication 1254 *Noise Control Guidelines* dated October 2008 provides guidance for two broad categories of PA systems:

- low-power units needed for control of persons engaged in the activities or events; and
- high-power units used for making public commentaries and announcements.

Extracts of the relevant guidance for each category is reproduced below:

> ***Low-power systems for event control***
>
> *These are usually small systems such as are used for controlling competitors in events like BMX bike races and go-kart races. Where such systems may cause noise annoyance, the following criteria should be applied:*
>
> - *The public address system must only be used to control the event, not for giving commentaries, advertising or playing music.*
> - *Speakers may only be installed in the essential control areas, such as marshalling sites.*
> - *Speakers should be small, low-power horn units no more than 20 cm across the horn opening and operated by an amplifier of no more than 30 watts.*
> - *Horn units are to incline downwards at an angle of approximately 45°, point in the appropriate direction and be mounted on poles approximately three metres tall, in such a way that the speaker is held firmly and cannot be rotated.*
> - *A sound level limiting circuit should be incorporated in the amplifier to control the signal amplitude to a fixed level, regardless of the loudness of the operator's voice.*
> - *Once the control knobs have been set to the correct positions, they should be removed and the potentiometer spindles covered with a fixed metal channel attached to the front panel of the amplifier.*
> - *The spare microphone inputs should be covered with metal plates securely fitted to the rear or front panel of the amplifier, as the case may be.*
>
> ***High-power systems for commentaries and announcements***
>
> *These are usually much larger systems used, for example, to give a running commentary during a sporting event or race meeting, to keep spectators entertained or for carnival-type advertising.*
>
> - *Most of the criteria for lower power systems are applicable.*
> - *Rather than use high-powered speakers placed in a few locations, it is preferable to place more low-powered speakers to cover the entire perimeter of the grounds, each pointing downward and inward towards the ground where the event is taking place.*
>
> *Note:*
>
> *1. Consideration should be given to substitution of sound systems by visual displays such as electronic scoreboards and video screens for large operations.*
>
> *2. PA systems used for paging staff and patrons in business and catering operations may also be replaced where they adversely affect residences. In business, two-way radios or pocket beepers may be used. In hotels, meal ticket numbers may be presented on digital display boards instead of being announced.*

APPENDIX D BACKGROUND NOISE SURVEY

The background noise survey comprised deployment of six (6) Class 1 environmental noise loggers (highest accuracy standard used for environmental noise surveys) at distributed locations around the subject site.

The loggers were configured to continuously measure noise levels at 10-minute intervals with 2-minute audio recordings for reference. Calibration checks were carried out prior to and post the survey period with no significant change in levels noted.

Table 18: Equipment details

Location	System	Serial number	Independent calibration date [1]	Calibration drift [2,3]
255 Watson Rd	01dB CUBE	10516	4 July 2018	0.4
415 McGregor Rd	01dB CUBE	10523	29 November 2017	0.1
317 McGregor Rd	01dB CUBE	10521	20 August 2018	0.9
145 Watson Rd	01dB CUBE	10513	11 July 2017	0.1
245 McGregor Rd	01dB CUBE 01dB DUO	10517 10495	30 July 2018 6 August 2018	See note[4] 0.1
30 Greenhills Rd	Rion NL-31 Rion NL-31	5038191 10040137	9 February 2018 17 January 2019	0.1 0.1

Note 1: Independent (laboratory) calibration date to be within 2 years of measurement period as per AS 1055:2018 *Acoustics - Description and measurement of environmental noise* (AS 1055)

Note 2: Difference between reference level checks during deployment and collection of instruments

Note 3: Calibration drift should not be greater than 1 dB as specified in AS 1055

Note 4: Calibration drift value for CUBE 10517 not available due to damage by livestock

The following disruptions occurred during the survey:

- 245 McGregor Road: the unit was damaged by livestock – valid data was not obtained from this location as of the morning of 11 March 2019 until a replacement unit was installed on the afternoon of 1 April 2019
- 255 Watson Road: a temporary monitor outage at this location resulted in no valid data being obtained between midnight and 1900 hrs on 29 March 2019.

The above periods are therefore excluded from the analysis for these locations.

Measurement data at all locations was also removed from the analysis if:

- Average wind speeds in the measurement hour were greater than 5 m/s
- Rainfall occurred during the measurement hour (indicated by a measured rain intensity value greater than 0 mm/hr)

A detailed summary of the background noise survey analysis results is provided in the following sections for:

- Background noise levels according to NIRV definitions of the day, evening and night period
- Background noise levels according to EPA Publication 1508 definitions of the day and evening.

D1 Background noise levels – NIRV/SEPP N-1 time periods

Table 19: Background noise levels summary – day period 0700-1800 hrs (dB L_{A90})

Receiver ID	1	2	3	7	13	14
Receiver address	**245 McGregor Rd**	**317 McGregor Rd**	**30 Greenhills Rd**	**415 McGregor Rd**	**255 Watson Rd**	**145 Watson Rd**
Minimum	44	40	41	38	33	33
10th percentile	46	42	42	39	39	35
Average	51	47	48	44	42	39
90th percentile	55	52	53	50	46	42
Maximum	56	54	54	58	49	49
08 March (Friday)	48	45	54	50	49	43
09 March (Saturday)	44	40	41	39	39	36
10 March (Sunday)	48	46	49	46	44	41
11 March (Monday)	48	43	48	45	41	37
12 March (Tuesday)	-	48	51	50	43	39
13 March (Wednesday)	-	44	46	42	41	39
14 March (Thursday)	-	42	43	41	40	37
15 March (Friday)	-	46	46	44	42	39
16 March (Saturday)	-	41	42	39	38	35
17 March (Sunday)	-	40	42	41	39	36
18 March (Monday)	-	49	49	44	42	42
19 March (Tuesday)	-	44	45	44	41	38
20 March (Wednesday)	-	41	45	41	42	38

Receiver ID	1	2	3	7	13	14
Receiver address	245 McGregor Rd	317 McGregor Rd	30 Greenhills Rd	415 McGregor Rd	255 Watson Rd	145 Watson Rd
21 March (Thursday)	-	43	45	41	41	36
22 March (Friday)	-	46	-	42	40	38
23 March (Saturday)	-	49	-	47	47	42
24 March (Sunday)	-	49	-	43	40	39
25 March (Monday)	-	54	-	58	46	49
26 March (Tuesday)	-	47	-	49	44	41
27 March (Wednesday)	-	44	-	40	39	35
28 March (Thursday)	-	51	-	44	42	39
29 March (Friday)	-	52	-	51	-	43
30 March (Saturday)	-	46	-	49	47	40
31 March (Sunday)	-	49	-	39	42	39
01 April (Monday)	46	45	48	38	41	33
02 April (Tuesday)	53	49	50	44	43	41
03 April (Wednesday)	51	47	52	45	46	39
04 April (Thursday)	54	51	53	44	45	42
05 April (Friday)	55	52	53	47	47	44
06 April (Saturday)	46	42	48	40	41	35
07 April (Sunday)	55	51	52	50	45	42
08 April (Monday)	56	52	53	47	44	41
09 April (Tuesday)	54	51	50	40	33	36

Table 20: Background noise levels summary – evening period 1800-2200 hrs (dB L_{A90})

Receiver ID	**1**	**2**	**3**	**7**	**13**	**14**
Receiver address	**245 McGregor Rd**	**317 McGregor Rd**	**30 Greenhills Rd**	**415 McGregor Rd**	**255 Watson Rd**	**145 Watson Rd**
Minimum	43	41	46	26	39	34
10th percentile	45	43	47	45	42	35
Average	49	47	51	47	48	40
90th percentile	56	51	54	51	53	43
Maximum	56	53	57	52	54	46
08 March (Friday)	48	46	54	52	52	42
09 March (Saturday)	45	47	54	51	54	43
10 March (Sunday)	43	47	54	51	53	41
11 March (Monday)	-	46	54	49	51	40
12 March (Tuesday)	-	41	48	49	42	37
13 March (Wednesday)	-	43	46	47	45	38
14 March (Thursday)	-	49	49	47	49	42
15 March (Friday)	-	53	47	49	50	41
16 March (Saturday)	-	52	50	47	52	42
17 March (Sunday)	-	51	51	45	50	40
18 March (Monday)	-	51	53	45	50	42
19 March (Tuesday)	-	46	50	48	51	40
20 March (Wednesday)	-	45	48	47	50	40
21 March (Thursday)	-	48	49	46	54	40

Receiver ID	1	2	3	7	13	14
Receiver address	245 McGregor Rd	317 McGregor Rd	30 Greenhills Rd	415 McGregor Rd	255 Watson Rd	145 Watson Rd
22 March (Friday)	-	50	-	46	51	45
23 March (Saturday)	-	47	-	49	53	40
24 March (Sunday)	-	51	-	51	52	43
25 March (Monday)	-	48	-	50	39	43
26 March (Tuesday)	-	43	-	47	41	39
27 March (Wednesday)	-	47	-	47	44	42
28 March (Thursday)	-	50	-	47	47	41
29 March (Friday)	-	48	-	50	-	42
30 March (Saturday)	-	48	-	46	39	37
31 March (Sunday)	-	45	-	26	44	35
01 April (Monday)	46	43	48	41	45	34
02 April (Tuesday)	56	52	57	46	54	41
03 April (Wednesday)	46	44	53	43	50	34
04 April (Thursday)	53	51	54	45	50	46
05 April (Friday)	56	51	54	47	53	42
06 April (Saturday)	48	42	47	45	42	35
07 April (Sunday)	51	47	50	48	46	41
08 April (Monday)	-	-	-	-	-	-
09 April (Tuesday)	-	-	-	-	-	-

Table 21: Background noise levels summary – night period 2200-0700 hrs (dB L_{A90})

Receiver ID	Receiver 1	Receiver 2	Receiver 3	Receiver 7	Receiver 13	Receiver 14
Receiver address	**245 McGregor Rd**	**317 McGregor Rd**	**30 Greenhills Rd**	**415 McGregor Rd**	**255 Watson Rd**	**145 Watson Rd**
Minimum	44	38	38	33	25	26
10th percentile	45	41	39	36	28	30
Average	47	47	45	45	41	38
90th percentile	48	53	49	52	52	45
Maximum	50	54	52	55	54	48
08 March (Friday)	45	43	45	52	40	40
09 March (Saturday)	46	45	46	52	47	45
10 March (Sunday)	44	49	48	46	48	43
11 March (Monday)	-	48	48	46	45	39
12 March (Tuesday)	-	41	39	33	26	27
13 March (Wednesday)	-	41	38	37	33	32
14 March (Thursday)	-	41	38	39	30	32
15 March (Friday)	-	45	41	43	38	35
16 March (Saturday)	-	54	48	45	51	40
17 March (Sunday)	-	52	50	50	49	42
18 March (Monday)	-	52	49	45	50	42
19 March (Tuesday)	-	53	49	47	52	44
20 March (Wednesday)	-	54	49	50	52	44
21 March (Thursday)	-	53	-	49	53	46

Receiver ID	Receiver 1	Receiver 2	Receiver 3	Receiver 7	Receiver 13	Receiver 14
Receiver address	245 McGregor Rd	317 McGregor Rd	30 Greenhills Rd	415 McGregor Rd	255 Watson Rd	145 Watson Rd
22 March (Friday)	-	52	-	51	54	48
23 March (Saturday)	-	49	-	50	53	45
24 March (Sunday)	-	52	-	55	52	48
25 March (Monday)	-	44	-	50	39	38
26 March (Tuesday)	-	45	-	39	27	29
27 March (Wednesday)	-	47	-	40	34	35
28 March (Thursday)	-	48	-	43	38	37
29 March (Friday)	-	45	-	54	39	36
30 March (Saturday)	-	43	-	49	36	33
31 March (Sunday)	-	38	-	35	30	29
01 April (Monday)	48	43	42	36	34	33
02 April (Tuesday)	50	49	47	46	38	36
03 April (Wednesday)	46	45	45	41	39	32
04 April (Thursday)	48	49	48	44	42	39
05 April (Friday)	47	49	52	49	49	42
06 April (Saturday)	46	40	39	34	25	26
07 April (Sunday)	45	43	42	40	28	30
08 April (Monday)	48	46	46	46	34	35
09 April (Tuesday)	-	-	-	-	-	-

D2 Background noise levels – EPA Publication 1508 time periods

Table 22: Background noise levels summary – day period 0900-1800 hrs (dB L_{A90})

Receiver ID	Receiver 1	Receiver 2	Receiver 3	Receiver 7	Receiver 13	Receiver 14
Receiver address	**245 McGregor Rd**	**317 McGregor Rd**	**30 Greenhills Rd**	**415 McGregor Rd**	**255 Watson Rd**	**145 Watson Rd**
Minimum	42	38	40	35	33	33
10th percentile	45	41	41	39	39	34
Average	50	46	47	44	43	39
90th percentile	55	52	53	51	47	43
Maximum	56	54	54	58	50	49
08 March (Friday)	48	45	54	50	49	43
09 March (Saturday)	42	38	40	39	39	35
10 March (Sunday)	48	46	51	47	47	41
11 March (Monday)	48	43	47	45	41	37
12 March (Tuesday)	-	47	51	51	43	39
13 March (Wednesday)	-	42	44	41	41	39
14 March (Thursday)	-	41	42	41	41	37
15 March (Friday)	-	44	45	44	42	38
16 March (Saturday)	-	40	40	38	38	34
17 March (Sunday)	-	38	40	40	39	34
18 March (Monday)	-	50	48	43	42	41
19 March (Tuesday)	-	42	43	43	40	37
20 March (Wednesday)	-	41	43	39	40	35

Receiver ID	Receiver 1	Receiver 2	Receiver 3	Receiver 7	Receiver 13	Receiver 14
Receiver address	245 McGregor Rd	317 McGregor Rd	30 Greenhills Rd	415 McGregor Rd	255 Watson Rd	145 Watson Rd
21 March (Thursday)	-	42	43	39	40	34
22 March (Friday)	-	44	-	40	38	36
23 March (Saturday)	-	49	-	45	45	41
24 March (Sunday)	-	51	-	46	43	40
25 March (Monday)	-	54	-	58	47	49
26 March (Tuesday)	-	47	-	49	44	41
27 March (Wednesday)	-	42	-	40	40	35
28 March (Thursday)	-	50	-	43	42	39
29 March (Friday)	-	52	-	52	-	42
30 March (Saturday)	-	46	-	49	47	40
31 March (Sunday)	-	47	-	35	47	40
01 April (Monday)	46	43	48	38	42	33
02 April (Tuesday)	52	48	49	43	43	41
03 April (Wednesday)	49	44	51	45	47	38
04 April (Thursday)	53	50	52	43	45	41
05 April (Friday)	55	52	53	46	47	43
06 April (Saturday)	45	41	47	39	41	35
07 April (Sunday)	56	52	54	55	50	44
08 April (Monday)	55	52	53	48	46	41
09 April (Tuesday)	54	50	49	40	33	36

Table 23: Background noise levels summary – evening period 1800-2200 hrs (dB L_{A90})

Receiver ID	Receiver 1	Receiver 2	Receiver 3	Receiver 7	Receiver 13	Receiver 14
Receiver address	**245 McGregor Rd**	**317 McGregor Rd**	**30 Greenhills Rd**	**415 McGregor Rd**	**255 Watson Rd**	**145 Watson Rd**
Minimum	43	41	46	26	39	34
10th percentile	45	43	47	45	42	35
Average	49	47	51	47	48	40
90th percentile	56	51	54	51	53	43
Maximum	56	53	57	52	54	46
08 March (Friday)	48	46	54	52	52	42
09 March (Saturday)	45	47	54	51	54	43
10 March (Sunday)	43	47	54	51	53	41
11 March (Monday)	-	46	54	49	51	40
12 March (Tuesday)	-	41	48	49	42	37
13 March (Wednesday)	-	43	46	47	45	38
14 March (Thursday)	-	49	49	47	49	42
15 March (Friday)	-	53	47	49	50	41
16 March (Saturday)	-	52	50	47	52	42
17 March (Sunday)	-	51	51	45	50	40
18 March (Monday)	-	51	53	45	50	42
19 March (Tuesday)	-	46	50	48	51	40
20 March (Wednesday)	-	45	48	47	50	40
21 March (Thursday)	-	48	49	46	54	40

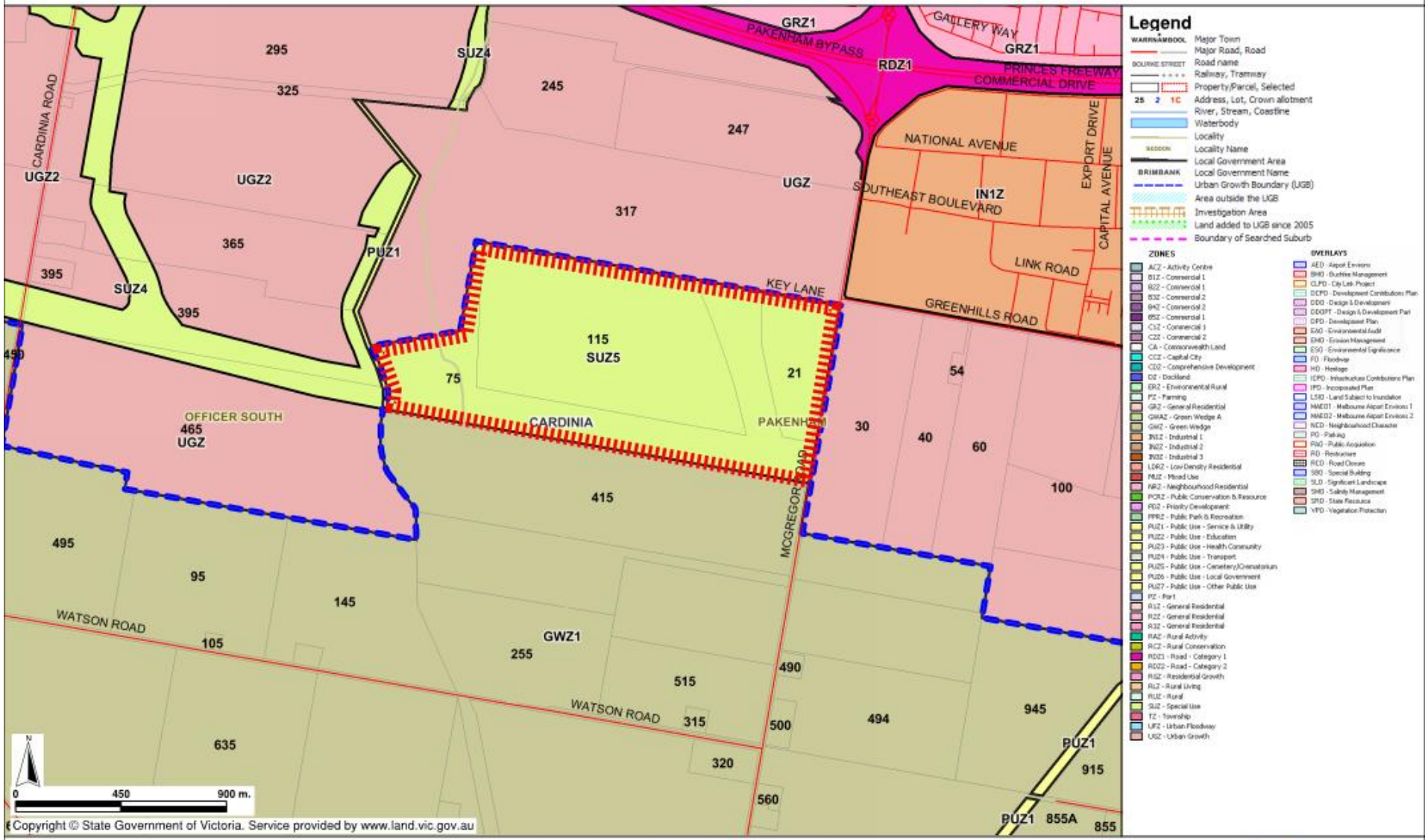
Receiver ID	Receiver 1	Receiver 2	Receiver 3	Receiver 7	Receiver 13	Receiver 14
Receiver address	**245 McGregor Rd**	**317 McGregor Rd**	**30 Greenhills Rd**	**415 McGregor Rd**	**255 Watson Rd**	**145 Watson Rd**
22 March (Friday)	-	50	-	46	51	45
23 March (Saturday)	-	47	-	49	53	40
24 March (Sunday)	-	51	-	51	52	43
25 March (Monday)	-	48	-	50	39	43
26 March (Tuesday)	-	43	-	47	41	39
27 March (Wednesday)	-	47	-	47	44	42
28 March (Thursday)	-	50	-	47	47	41
29 March (Friday)	-	48	-	50	-	42
30 March (Saturday)	-	48	-	46	39	37
31 March (Sunday)	-	45	-	26	44	35
01 April (Monday)	46	43	48	41	45	34
02 April (Tuesday)	56	52	57	46	54	41
03 April (Wednesday)	46	44	53	43	50	34
04 April (Thursday)	53	51	54	45	50	46
05 April (Friday)	56	51	54	47	53	42
06 April (Saturday)	48	42	47	45	42	35
07 April (Sunday)	51	47	50	48	46	41
08 April (Monday)	-	-	-	-	-	-
09 April (Tuesday)	-	-	-	-	-	-

APPENDIX E PLANNING MAP

Planning Map

SUZ5

Department of Environment, Land Water and Planning

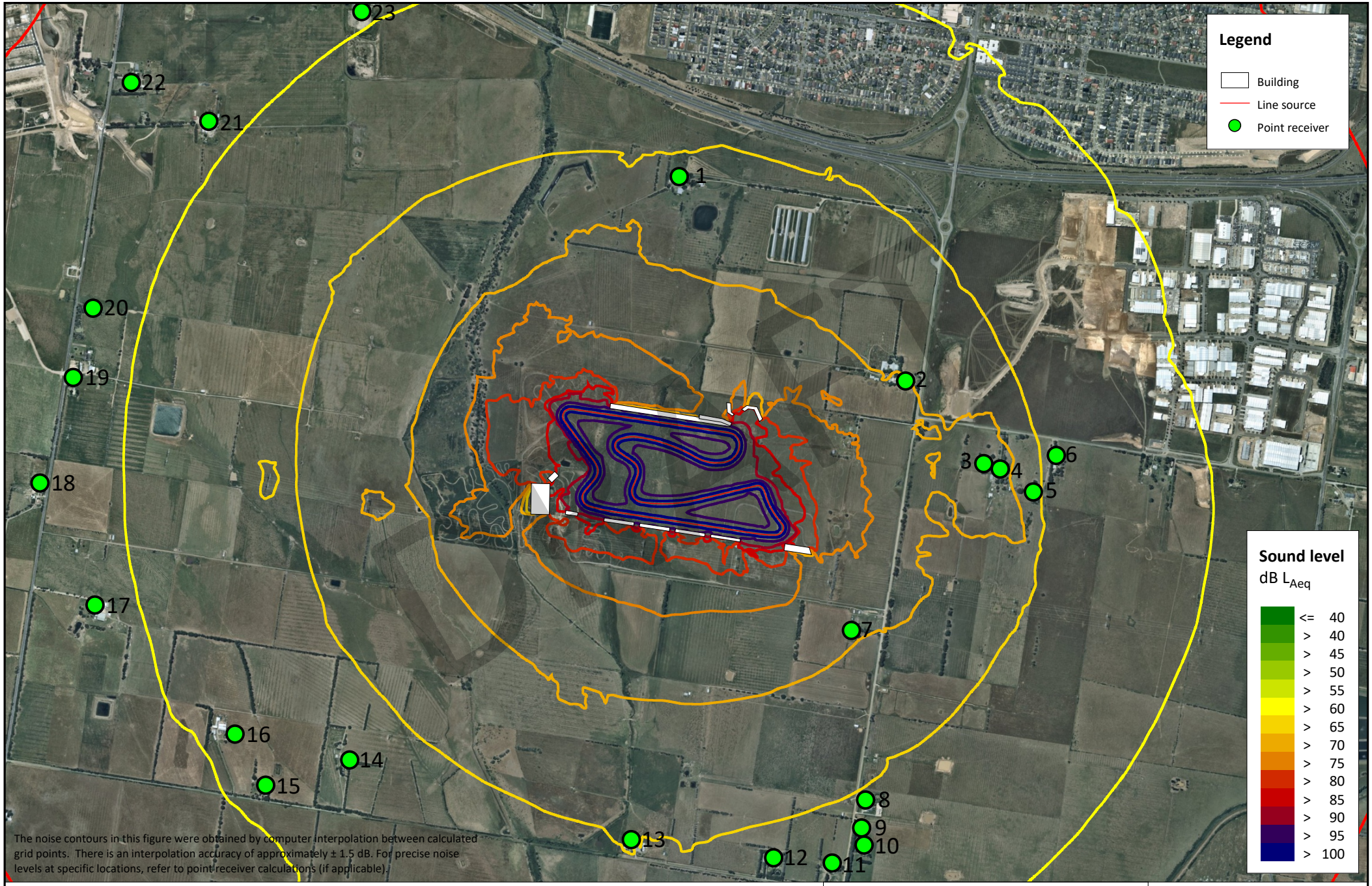


Map Centre - Melways 322 H4
Map Scale 1:21,466
May 10, 2019 4:39:21 PM

VICTORIA State Government | Environment, Land, Water and Planning

APPENDIX F INDICATIVE NOISE CONTOURS

F1 Main circuits – competition use of the full international circuit



MARSHALL DAY Acoustics

Cardinia Motorsport

Competition, full international circuit event (x30 cars)

Project: Cardinia MotorSport
Project no: 20181004 Run no: 0
Filename: 1009a Prelim calc - 30 cars (Lmax 95dBA at 30m) - lines only
Prepared by: BBEV Date: 23/04/2019

0 50100 200 300 400 m

N

F2 Karting circuit – competition use

MARSHALL DAY Acoustics

Cardinia Motorsport

Competition, karting circuit (x24 karts)

Project: Cardinia MotorSport
Project no: 20181004 Run no: 0
Filename: 1201a Prelim calc - Go Karts (9-16 HP), no mit - lines only
Prepared by: BBEV Date: 23/04/2019