The Victorian Environment Reference Standard and how it has been considered and applied in noise assessments

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Abstract - The subordinate legislation made under the Victorian *Environment Protection Act 2017* (the Act) includes an *Environment Reference Standard* (ERS) that was gazetted on 26 May 2021 and commenced, with the Act, on 1 July 2021. The ERS covers ambient air, ambient sound, land, as well as ground and surface water. Although it is not a compliance standard and does not take precedence over direct regulation, the ERS is an important tool to support the preventative approach to environment protection of the Act. It defines environmental values to consider when assessing the impacts on human health and the environment that may result from a proposal or activity, or from existing environmental conditions on a site. These values reflect desired outcomes for human health and the environment, such as (for ambient sound) sleep at night, child learning and development, normal domestic and recreational activities and enjoyment of natural areas. This paper presents a review of how the ERS has been considered when assessing the risks associated with noise.

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This document does not constitute legal or other professional advice and should not be relied on as a statement of the law. Because it has broad application, it may contain generalisations that are not applicable to you or your particular circumstances.

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2 VICTORIAN ENVIRONMENT PROTECTION LEGISLATION

The *Environment Protection Act 2017* (Vic) (the Act) came into effect on 1 July 2021. The Act gives EPA enhanced powers and tools to prevent and minimise the risks of harm to human health and the environment. Importantly, it includes positive obligations, such as the general environmental duty which requires all Victorians engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste (including noise) to minimise those risks, so far as reasonably practicable. The Act also includes in its sections 166 and 167 obligations to not emit or permit to emit unreasonable noise.[1]

Subordinate legislation made under the Act includes the *Environment Protection Regulations 2021* (Vic) (the Regulations) and the *Environment Reference Standard* (ERS) (State of Victoria, 2021). For noise sources subject to the Regulations, noise limits and/or operation restrictions apply, beyond which noise is prescribed to be unreasonable. In contrast the ERS does not set obligations. Rather, it provides an environmental benchmark that

[1] Unreasonable noise is defined in section 4 of the Act. Specific guidance on the matter can be found in the *Unreasonable noise guidelines* (EPA Victoria, 2023)

describes environmental or health outcomes to be achieved or maintained in Victoria. These outcomes are reflected as environmental values defined in the ERS, which also includes indicators and objectives that can be used to assess whether there may be risks to the environmental values. While direct regulation takes precedence, there are circumstances for which Victorian laws state that the ERS *must* be considered to inform decision making (for example when EPA assesses licence applications) and situations where the ERS *may* be considered (such as when a planning Responsible Authority decides on an application for a planning permit).

A general description of the ERS can be found on EPA's website (EPA Victoria, 2024)**.** The *Guide to the Environment Reference Standard* (EPA Victoria, 2021) provides detailed guidance on its use and its application.

3 THE ERS FOR AMBIENT SOUND

Part 3 of the ERS relates to ambient sound. It defines six environmental values and indicators and objectives that apply according to different land use categories. Information on how the ERS was developed is provided in the impact assessment prepared in 2019 to facilitate public consultation on the proposed ERS (DEWLP & EPA Victoria, 2019). Appendix E of this impact assessment reports an assessment by Victoria's Chief Environmental Scientist of the standards in the ERS.

Table 1 – ERS Environmental values for ambient sound

Environmental value	Description
Sleep during the night	An ambient sound environment that supports sleep at night
Domestic and recreational activities	An ambient sound environment that supports recreational and domestic activities in a residential setting
Normal conversation	An ambient sound environment that allows for a normal conversation indoors without the need to raise voices
Child learning and development	An ambient sound environment that supports cognitive development and learning in children
Human tranquillity and enjoyment outdoors in natural areas	An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas
Musical entertainment	An ambient sound environment that recognises the community's demand for a wide range of musical entertainment

3.1 Environmental values

The ERS for ambient sound reiterates the environmental values that were contained in the State Environment Protection Policies (SEPPs) for noise[2] that were made under the *Environment Protection Act 1970* (Vic) and were in force prior to the commencement of the 2017 Act. These values are sleep during the night, domestic and recreational activities and normal conversation.

[2] *State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No. N-1* (State of Victoria, 1989) and *State Environment Protection Policy (Control of Music Noise form Public Premises) No. N-2* (State of Victoria, 1989)

The ERS also adopts three additional environmental values: child learning and development, human tranquillity and enjoyment outdoors in natural areas and musical entertainment. The first two were identified through a review of the noise SEPPs conducted 2014-2018 (DEWLP & EPA Victoria, 2019). The environmental value of musical entertainment was added to the ERS for ambient sound following feedback received during the public consultation for the subordinate legislation supporting the Act, conducted in October 2019.

3.2 Indicators and objectives

Part 3 of the ERS includes indicators and objectives defined to provide a way to assess the environmental values for ambient sound. The indicators and objectives are defined for five land use categories that characterise the different urban form and land use settings that are typically associated with urban, regional, rural and natural areas in Victoria. The intent is to provide a suitable level of granularity and simplicity, while recognising that the ambient sound environment varies in different urban settings, and so does the balance between existing and likely activity associated with future development. The land use categories range from highly urbanised (Category I) to rural (Category IV) and natural areas (Category V).

Indicators and objectives for land use categories I to IV are expressed as outdoor L_{Aeq} (free field) for the 6am to 10pm day period (inclusive of the evening hours) and for the 10pm to 6am night period. The choice of L_{Aeq} was made consistent with other Australian and international jurisdictions, as it is the most common indicator to provide a representation of the average quality of the ambient sound environment over time, in the long term. The objectives for land use categories were established considering 5-10 dB increments to provide an adequate level of granularity for the spatial distribution of ambient noise levels across settings with varying urban development intensity.

For Category V land use for which the environmental value of human tranquillity and enjoyment outdoors in natural areas applies, the indicator is qualitative, and the objective is *'a sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape*'.

4 APPLYING THE ERS IN ACOUSTIC ASSESSMENTS

Within EPA, the Science Division is involved in reviewing technical reports that document the assessments supporting development and operational licence applications, planning applications referred to EPA, or Environmental Effect Statements for which EPA is part of technical reference group.

This has been the opportunity to observe how the ERS was considered and interpreted. For ambient sound, a few recurrent issues were identified, including:

- applying the ERS indicators and objectives in a compliance-based approach
- applying Category IV objectives to natural areas.

4.1 Limitations of the L_{Aeq}-based indicators

Several projects considered a compliance-based approach by which noise levels were assessed against the $L_{Aeq,16h}$ and $L_{Aeq,8h}$ indicators and objectives. If predicted noise levels were found to meet the objectives, it was then claimed that there is no, or minimal, risk to the environmental values.

This is an oversimplification. The ERS is not a compliance standard. While the indicators and objectives for ambient sound provide a way to assess the risk to the environmental values, it is not a one-size fits all approach. Exceeding the $L_{Aeq,16h/8h}$ objectives would indicate an increased risk to the environmental values but meeting them does not necessarily mean that there is no risk.

It is important to recognise the limitations of the long term L_{Aeq}-based indicators and objectives. As an aggregate of the pressure sound pressure level across the full frequency spectrum into a single number, $L_{Aeq,T}$ is generally recognised as a practical metric for environmental impact assessments. It is generally sufficient to characterise simple, well understood situations, such as when the noise is steady or quasi-steady (e.g. continuous road traffic or industry rumble). However, it provides little information, if any, on how the intensity and the frequency spectrum of the sound vary across the measurement time *T*, or across the (long term) averaging period.

By themselves L_{Aeq}-based metrics are limited in their ability to represent the intrusiveness and impacts of noise in more complex circumstances, such as transient, intermittent or sporadic noise (from trains, aircraft, individual loud road vehicle pass-by, construction noise, etc). Due to the A-weighting they are also limited for the assessment of noise with high energy in the low frequency range.

The misconception that assessment based on $L_{Aeq,T}$ are sufficient for all situations is not limited to the application of the ERS. It is not uncommon to see acoustic reports nominating criteria based on recommendations for L_{Aeq}-based values in health guidelines, such as (World Health Organization, 2018), (World Health Organization, 2009) or (enHealth, 2018), and concluding there was no risk to human health because the 'health-based guidelines criteria were met'. This is also an oversimplification. Section 4.4 of the WHO *Guidelines for community noise* (World Health Organization, 1999) states: *It is not enough to characterize the noise environment in terms of noise measures or indices based on energy summation (e.g.* L_{Aeq}*), because different critical health effects require different descriptions*. The European Noise Directive (European Union, 2002) also recognises in its Annex I that supplementary noise indicators to L_{den} and L_{night} may be advantageous to use in some circumstances such as sporadic events, transient events with relatively low occurrence (such as passing trains or aircraft), impulsive character strong low frequency content, strong tonal component, combination of noises from different sources, or quiet areas in open country.

Where the L_{Aeq}-based ERS indicators are not sufficient to describe and assess the risks to the environmental values, an approach could be to consider additional metrics that provide a better insight into the impacts the noise may have. The *Guide to the Environment Reference Standard* (EPA Victoria, 2021) recognises in its Appendix B that measurements with shorter time intervals than 16 or 8 hours can be used to provide information on the time-varying nature of the sound environment. It also highlights the relevance of considering frequency spectrum and statistical levels, in addition to $L_{Aeq,16h}$ and $L_{Aeq,8h}$, for a more detailed assessment.

4.2 Protecting the environmental values is the primary consideration

Even when supplementary indicators are used to measure and assess the ambient sound environment, it may be difficult to quantify and assess the risk to the environmental values. For example, while there is somewhat extensive literature on the impacts of general road traffic and aircraft noise on sleep and on child learning and development, there are less studies in relation to other sources of noise or other environmental values.

In many situations, there may not be accurate methods to quantify and assess the impacts associated with noise and evaluate whether and how it can be a threat to the environmental values. However, this does not mean nothing can be done to *prevent* or address *risks* to these values. In the common appreciation of *risk* being a combination of both likelihood and consequence, one doesn't necessarily need to quantify the consequence to take actions to reduce the likelihood.

The definition of *harm* in section 6 of the Act, as meaning 'an adverse effect on human health or the environment (of whatever degree or duration)' (emphasis added). In this context, seeking to proactively adopt preventative measures has more value than attempting to define and assess against quantified noise criteria deemed acceptable levels of noise pollution.

For example, risks from construction noise to sleep at night and to normal domestic and recreational activities can be significantly reduced if works are scheduled during normal working hours, and activities occurring at night or during the evenings and weekends are limited to works that cannot occur at another time, or for which specific actions are taken to minimise noise impacts. Details for such an approach can be found in Chapter 4 of the *Civil construction, building and demolition guide.* (EPA Victoria, 2023)

Similarly, risks associated with transient noise from heavy vehicle passing by residences or other sensitive uses can be eliminated or reduced by adequate scheduling of material transport and route selection. Other measures include ensuring vehicles are well maintained and fitted with functioning mufflers, avoiding noisy acceleration/deceleration and tailgate rattling, and preventing the unnecessary use of engine brake (so it is used only when justified for safety reasons on long downhill slopes). These are measures that a project can implement in a transport management plan and/or a code of practice for heavy vehicle drivers.

A qualitative approach to preventing sleep at night is also discussed in (Konchery, Sacharz, Buret, & Just, 2024).

4.3 Natural areas

The ERS defines natural areas as being:

> *national parks, state parks, state forests, nature conservation reserves, wildlife reserves and environmentally significant areas and landscapes outside metropolitan Melbourne that are identified in a planning scheme*.

It also includes specific provisions for natural areas:

- they are classified as land within Category V irrespective of the land use zoning. unlike other land use categories which are defined based on planning zones
- they are where the environmental value of human tranquillity and enjoyment outdoors in natural areas applies
- the indicator for Category V land is qualitative and the objective is *a sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape*.

Since the commencement of the ERS, EPA has observed that several projects had difficulties in interpreting and implementing the ERS in natural areas, including issues with identify whether land was a natural area, and with assessing the environmental value of human tranquillity and enjoyment outdoors in natural areas.

4.3.1 Identifying natural areas

While it is straightforward to categorise a national park, a state park, a state forest as Category V land, it is not always as obvious to identify other natural areas. There are instances of land such as bushland reserves, forest plantations or some public conservation and resource zones that could be natural areas but for which there is limited information.

A desktop review of the area considered may indicate whether the language used to describe it is consistent to that of natural areas. However, without a particular knowledge of an area or the purposes for which it is reserved, it may not be possible to assess whether or not it would be ‘natural areas’ under the ERS.

The definition of natural area in the ERS includes ‘nature conservation reserves’ and ’wildlife reserves’ but does not expressly define these terms. It may then be reasonable to adopt or align with the meanings of, respectively,

'nature conservation reserves' under the *Crown Land (Reserves) Act (Vic) 1978* and of 'state wildlife reserves' under the *Wildlife Act (Vic) 1975*. However, it would be useful to seek clarity from the Victorian Department of Energy, Environment and Climate Action (DEECA), which administers both these acts.

In any case, in the absence of sufficient clarity, it would be consistent with the principle of primary of prevention and the precautionary principle (section 15 and 20 of the Act, respectively), that an area that is potentially a natural area be considered so, and to assess noise affecting it having regard to the environmental value of human tranquillity and enjoyment outdoors in natural areas.

4.3.2 Assessing human tranquillity and enjoyment outdoors in natural areas

EPA has been aware of several projects that appear to have overlooked the requirement for a qualitative assessment of human tranquillity and enjoyment outdoors in natural areas, and instead relied on L_{Aeq}-based criteria only.

Most of these projects have applied the objective for Category IV land uses, claiming that the use of the natural area was similar to that of land use zones that are under Category IV, such Rural Conservation Zones (RCZ) or Public Conservation and Resource Zones (PCRZ),. However, the ERS explicitly requires natural areas to be classified within Category V irrespective of the planning zones applying to the land and the qualitative indicator and objective.

Another approach that has been observed, is to measure the pre-existing $L_{Aeq,16h}$ and $L_{Aeq,8h}$ and adopt criteria for introduced sounds set 10 dB below these measurements, on grounds that they would not increase the noise levels within the natural area. This argument is however misleading. The L_{Aeq}-based indicators are too limited to assess whether the ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas.

An L_{Aeq} measurement can provide information on the average loudness of the ambient sound environment and of introduced sounds, but not how these sounds are experienced by visitors to a natural area or whether the pre-existing environment or introduced sound will affect the tranquillity and enjoyment of the area.

The frequency spectrum of an introduced sound, its potential character and variability can all influence how the sound can impact on human tranquillity and enjoyment outdoors in natural areas. Even low-level non-natural sounds can be heard in natural settings if they present a tonal, impulsive or intermittent character, or if their signal otherwise differs from the timing and the frequency spectrum of the sounds of nature. The achievement of the qualitative objective is site specific and is based on whether the noise is compatible with or disturbing in the setting. (EPA Victoria, 2021)

There can still be value in conducting sound measurements against quantified benchmarks. However. these need to be defined carefully to ensure that they adequately reflect whether the sounds are appropriate in the settings considered. Assessing against quantified a criterion, or a combination of criteria, should be done after having established its ability to represent the human tranquillity and enjoyment outdoors in natural areas, and to provide an understanding of whether and to which degree, the environmental value is maintained or threatened. Brown and Muhar (Brown & Muhar, 2004) discuss translating proposed acoustic environments to measurable acoustic parameters in the context acoustic design of outdoor spaces. A similar approach can be considered for the assessment of natural areas.

5 THE ERS AS A TOOL TO INFORM POLICY DEVELOPMENT

Contemporary regulatory policy development often focuses on how the risks an activity poses can be balanced with the benefits it provides. Such work requires risk thresholds to be quantified using available information. To inform a review of its outdoor entertainment event permitting framework, EPA is conducting investigative work into potential trends across different events.

In this context, the five land use categories defined for ambient sound in the ERS have been found to be useful for predicting risk levels of noise emitting activities. These categories can be considered to scale the level of protection different areas require from noise pollution, with urban categories needing less protection that rural or natural areas due to a typical louder ambient sound environment, and a likely higher tolerance to new sounds. They provide a framework by which the risks associated with the location of an event could be ranked. When considered in combination with other variables, such as sound power, duration of the event, character of the noise and social licence, the risk profile of an activity could be described. This would allow identify common risk profiles that can inform considerations for regulatory intervention.

6 CONCLUDING REMARKS

The ERS is an important instrument in the legislative framework under the *Environmental Protection Act 2017* (Vic). For the management of environmental noise, it enables focussing on the *outcome* (the environmental values for ambient sound) rather than on targets (‘levels one can pollute up’). In doing so, it facilitates departing from compliance-based approaches that are not consistent with the risk-based framework under the *Environmental Protection Act 2017* (Vic).

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