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A Report to Tweed Shire Council:

# Effects of gunshot noise on domestic pets and mitigation measures to prevent negative impacts on animal behaviour and welfare – Updated 28 July and 16 August 2023

By Dr Kate Mornement

# 1. Introduction

Tweed Shire Council is building a new animal shelter/pound facility located at 92-102 Lundberg Dr, South Murwillumbah. There is a pistol club located adjacent to the Southern site boundary of the property. It is anticipated that there will be an annual intake and temporary impounding of approximately 443 dogs and 242 cats per year. Friends of the Pound (FOP) will operate a rehoming shelter adjacent to the Council run animal pound.

I have been engaged by Council to provide advice on the potential impact of gun fire noise on the behaviour and welfare of domestic animals housed in the facility. In addition, I was asked to provide advice and practical guidelines on how these impacts can be mitigated as well as how to reduce excessive barking in general. Furthermore, on 18<sup>th</sup> July 2023 and 10<sup>th</sup> of August I was asked to update this report to address Council planner queries. The updates and responses to these can be found referenced and responded to throughout this report under relevant sections.

### 2. Auditory Stress and its impact on domestic pets in a shelter environment

Noise has been found to be a physical stressor on animals that can lead to behavioural, physiological, and anatomical responses (Coppola et al., 2006). Noise-induced cortisol increases can cause immunosuppression, insulin resistance, cardiovascular diseases, catabolism (molecular decomposition), and intestinal problems (Spreng, 2000).

The hearing of animals differs from that of humans; dogs have much better hearing and can hear sounds up to four times quieter than can the human ear. Research shows that noise in dog kennels may be a welfare concern for the animals (Sales et al., 1997). Dogs in kennels are known to be exposed to noise levels known to be stressful to animals potentially negatively impacting their welfare. Several such studies suggest that prolonged exposure to loud noises can

cause hearing damage and loss in humans. The auditory systems of humans and dogs are very similar so noise levels that adversely impact human hearing may have a similar impact on that of dogs. That said, dogs are able to detect sounds ranging in frequency from 40 Hz to 50 kHz while people can only hear up to 20kHz. This suggests dogs may be even more prone to noise distress than people when in the same environment (Garvey et al., 2017).

Sources of noise in a kennel environment include barking from dogs, use of equipment and routine husbandry procedures. For example, high pressure hoses used during cleaning emit sound in the ultrasonic range, inaudible to humans, which could reach 90dB. Other common noises include ventilation systems, temperature control devices, food and water bowls, doors opening and closing and motor vehicle traffic (Garvey et al., 2017).

Sound levels ranging from 85-100 dB are common in dog kennels and exposure to these high levels of noise throughout the day puts animal and people at risk of damage to their hearing and may also reduce the quality and quantity of sleep dogs experience. Auditory stress is a serious animal welfare concern (Garvey et al., 2017).

Monitoring and reducing excessive noise in the shelter environment is therefore essential to create a more positive environment that results in better health and welfare outcomes for animals and people. Sound monitoring equipment can be expensive, however sound detector apps, available on most mobile phones, are a cost effective and practical way to monitor sound levels on a regular basis (Garvey et al., 2017).

# 3. Impact of noise from gun fire on domestic pets - updated 28 July 2023

Specific information relating to the impact of noise from gun fire on domestic pets is lacking in the scientific literature. Available information from early experiments showed that gun fire noise, at close range, is detrimental to cats (Price, 1978; Price & Wansack, 1989). Despite this lack of data in the literature, it is generally accepted that loud noise, particularly in the shelter, pound or kennel environment is a source of stress for animals and compromises their welfare.

Sound levels ranging from 85-100 dB are reportedly common in kennel and shelter environments and, as discussed previously, sources of noise in such environments often includes barking from dogs, use of equipment and routine husbandry procedures such as high pressure hoses which can reach 90dB. Other common noises include ventilation systems, temperature control devices, food and water bowls, doors opening and closing and motor vehicle traffic (Garvey et al., 2017).

The acoustic report provided to me by council stated that the highest LZPeak value measured from gunshot noise from the pistol club adjacent to the site of the proposed animal shelter and pound was 87dBZ. This level falls on the lower end of the scale of noise reported in similar environments. Furthermore, noise from other sources, such as barking dogs, within the facility itself will likely be more prominent and problematic.

I also acknowledge that the latest acoustic report advises that the inclusion of acoustic absorptive treatments to kennels will assist in reducing some of the reverberant level of external noise sources. In addition, there are a number of management controls listed, as well as kennel construction requirements and internal construction requirements that will facilitate the mitigation of this risk, as detailed by the acoustic consultant. Futureproofing (Section 8.5 of the report) also provides additional options to reduce gunshot noise should the intended measures be insufficient. Finally, Section 8.1 of the report confirms that a number of kennels will be upgraded to provide a higher degree of acoustic attenuation over and above the standard kennels for dog experiencing heightened levels of stress, fear or anxiety in response to the noise.

Update - On 18th of July 2023 I was asked to address:

- RFI item 4 Animal expert advice

The additional information supplied by the Acoustic consultant is to be referred to the animal expert to determine the following: *What is the likely impact on the dogs behaviour, solely in relation to noise generation, occurring because of the dogs hearing a high number of gunshots over a short period of time?* 

### Response:

The likely impact on the dogs behaviour as a result of the increased number of gunshots over a short period of time is an increase in fear or anxiety related behaviour, including barking. Although research specifically investigating the impact of gunshot noise and duration on dog behaviour and welfare is lacking in the scientific literature, studies looking at the impact of loud noises on the behaviour and welfare of kenneled dogs are available. Research suggests prolonged stays of 6 months or more in a kennel environment can cause hearing damage to dogs (Scheifele et al., 2012). It is noted, however that most dogs will be housed in the pound for a much shorter period of time (around two weeks).

Some dogs, such as working breeds, are typically more sensitive to loud noises compared to other breeds. This means that there will likely be a degree of individual differences when it comes to how different dogs respond to and cope with the gunshot noise with some dogs likely to be impacted more than others. However, habituation may occur where some dogs become used to the sound, and are less affected to it, over time.

It is noted that the updated measurements from 22 April 2023 in the acoustic report show the highest LZPeak value measured from gunshot noise from the pistol club was 94dBZ, which is marginally higher than the initial measurement of 87dBZ but still within the range of noise reported in similar environments. It is also noted that the Pistol Club holds shooting meets twice on Saturdays and once on a Wednesday morning, and that NSW Police uses the pistol club for firearm training purposes regularly with an estimate of an average of 2,500 rounds being shot each week. Although the total number of shots within an hour, day or week do not affect the noise assessment, each one of these shots is a potential fear or anxiety provoking event for the shelter animals and likely to trigger reactive barking in at least some of the dogs. This will likely result in increased barking from dogs whenever gunshots are audible.

The time it takes for dogs to habituate to loud noises occurring on a daily or weekly basis can vary depending on several factors, including the individual dog's temperament, prior experiences, and the specific characteristics of the loud noises (Blackwell et al., 2013). Habituation is the process by which an animal becomes desensitized to a repeated or continuous stimulus, leading to a reduced response over time. However, it is essential to note that not all dogs will habituate at the same rate, and some may never fully habituate to certain loud noises. Too much stress or fear during the habituation process can lead to sensitization rather than habituation, making some dogs even more reactive to the noise. The expected duration of the stay of these animals is limited to applicable statutory time frames as outlined within Section 8 of the Therian Needs Analysis and is expected to be weeks. This is preferential in terms of impact on animals as opposed to long periods of stay.

Factors influencing the habituation process to loud noises in dogs housed in kennels:

- 1. **Intensity of the Noise:** Louder and more intense noises may take longer for a dog to habituate to compared to milder or less frequent noises.
- 2. **Consistency and Duration:** Daily or consistent exposure to loud noises can expedite the habituation process, while intermittent or unpredictable exposure may slow it down.
- 3. **Past Experiences:** Dogs with previous positive experiences during exposure to loud noises may habituate faster than those with negative or fearful associations.
- 4. **Genetic Predisposition:** Some dog breeds may have a higher tolerance for loud noises due to their genetic traits.
- 5. **Socialization:** Dogs that are well-socialized and exposed to a variety of stimuli during their critical developmental period may adapt more readily to loud noises.
- 6. Age: Puppies may generally habituate faster to new experiences than older dogs.
- 7. Fear and Anxiety Levels: Dogs with pre-existing fear or anxiety issues may take longer to habituate to loud noises.
- 8. **Training and Counterconditioning:** Proper training and counterconditioning techniques can aid in speeding up the habituation process. However this can be difficult in a shelter environment with competing priorities and when the loud noises occurs outside of training sessions.
- 9. Length of Stay: Generally, the longer a dog's stay in a kennel or shelter environment the more likely they habituate to loud noises.

### 4. Impact of noise from excessive dog barking on domestic pets in animal shelters

Most noise in the kennel environment comes from barking dogs (Garvey et al., 2017). Excessive barking is a major source of noise pollution in animal shelter and kennel environments and negatively impacts welfare (Zurlinden et al., 2022). This is problematic because prolonged exposure to barking in a kennel environment can damage hearing in both people and dogs (Scheifele et al., 2012). It can also reduce the time potential adopters spend in the shelter looking at prospective dogs to adopt (Coppola et al., 2006). I acknowledge that the current design aims to

mitigate this noise risk with sensitive kennel orientation, site lines, landscaping, parade and show areas, exercise areas etc.

Dogs bark for different reasons in the kennel environment. The behaviour could be self-reinforcing (result in a desired outcome) for some dogs, related to over-excitement, fear, anxiety or territorial behaviour or triggered by loud noises or other dogs barking in the immediate environment. Routine cleaning and husbandry procedures may also result in barking from dogs anticipating food or attention (Garvey et al., 2017).

Cats in the shelter environment are also negatively impacted by barking from dogs. McCobb et al., (2005) found that cats that were housed where they could see, hear or smell dogs had elevated urine cortisol: creatinine ratios and 25% had signs of systemic illness. In the study, which examined stress levels in cats across four different animal shelters, concluded that the biggest factor affecting stress levels in cats was the extent to which they were exposed to dogs. When combined with other environmental stressors it had a cumulative effect, increasing stress levels. Other research has also found cats in noisy rooms, that were exposed to a range of disturbances including barking from dogs, where observed in distress. These findings provide strong evidence for the need to prevent cats being exposed to prolonged excessive noise to avoid causing undue stress and adverse health condition (Stella, 2013).

Reducing excessive barking in the animal shelter or pound setting is crucial to ensure optimal welfare and well-being of both the animals temporarily living in the premises and the people who work there.

Update - On 18th of July 2023 aside from the formal RFI I was asked to address:

- The likelihood of the maximum 42 dogs barking being unlikely in line with the needs analysis.

### Response:

According to the needs analysis, the prosed animal shelter will house a maximum of 42 dogs at any one time, however it's unlikely to reach or remain at capacity for extended periods of time. It should be noted that external variables such as natural disasters, cost of living increases, housing availability and other factors can result in fluctuations in the number of animals needing temporary care in shelter facilities.

I further acknowledge that, according to the Therian Needs Analysis, it is expected that the facility will only be partially occupied, resulting in fewer dogs being housed at any one time. Table B in Section 10.2 (page 12) of the report dated 05.03.21, states a required minimum design capacity of 19 dog kennel pens indicating that a 42 kennel facility is likely to operate at approximately 50% capacity in general. It is therefore unlikely that 42 dogs will bark at any onetime given the above and due to individual differences in behaviour and perceptions of loud noises.

Update – On 10<sup>th</sup> of August aside from the formal RFI I was asked to address the following comment:

e. The consultant has indicated that an animal behaviourist would need to determine the potential impacts on the animals within the housing facility and how that may impact noise generated from the subject site and its impacts on the neighbouring residential receiver. EH does note that the acoustic consultant has assumed all 42 dogs barking, however, it is recommended that the animal behaviourist review the revised acoustic report for completeness.

#### Response:

I have reviewed the revised acoustic report. The potential impacts on the animals within the housing facility have been discussed in previous responses. To reiterate, potential impacts (as discussed previously) include increased fear/anxiety and barking in response to increased gunshot noise. This is more likely to occur when gunshots are audible. Measures have been proposed throughout the acoustic report to decrease this noise. I understand that the acoustic consultant has assumed all 42 dogs barking at the same time. Again this is unlikely to be the case due to individual differences in behaviour and perceptions of loud noises.

It's important to understand that any loud noise can trigger fear/anxiety and barking from some dogs. Common sounds that elicit such a response include thunderstorms, fireworks, machinery etc. Other events, such as people walking past or routine feeding, cleaning or walking, can also elicit fear/anxiety based or anticipatory barking from dogs housed in a kennel environment (Zurlinden et al., 2022).

See the following section of the report for recommendations to mitigate negative impacts of barking in the shelter or kennel environment.

# 5. Recommendations to mitigate negative impacts of barking in the shelter environment

Animal shelter, pound and kennel environments can be very stressful for many dogs. The novel environment, loss of familiar routine and attachment figures, new sites and smells, unfamiliar dogs and people can contribute to stress, fear anxiety and other negative emotions and behaviours.

Research on the behaviour and welfare of animals temporarily housed in animal shelters and kennel facilities has identified a number of effective strategies for optimizing animal welfare and reducing stress, anxiety and associated problem behaviour including excessive barking. These include:

#### Human interaction sessions

Studies have found that interaction with staff or volunteers can help to alleviate stress, improve behaviour and reduce excessive barking in shelter dogs. For example, a study by Coppola et al., (2006b) found that a 45 minute session with a person on day two following admission to the shelter was associated with reduced salivary cortisol levels. The session involved taking the dog into an outdoor enclosure, playing with them, grooming, patting them and practicing basic obedience. Salivary cortisol levels were measured in each dog on their 2nd, 3rd, 4th and 9th day of housing. Dogs that engaged in a human contact session had lower cortisol levels on day 3 than animals that did not. A human interaction session can be beneficial to both animal welfare and adoption procedures as this study not only utilized the human contact session as a treatment to reduce stress but also as a resource for individual temperament/personality information that could be later used to facilitate compatible adoptions.

Similar sessions could also be utilised on during busy times at the pistol club when gunfire is loudest and most frequent. Staff and/or volunteers could be trained to provide these sessions.

### Classical Counter-conditioning

Classical counterconditioning, also known as Pavlovian conditioning, can be implemented in the shelter and pound environment by staff, volunteers or even members of the public to help change the way the dogs feel when a person enters the kennel area from unpleasant to pleasant. This should help to reduce excessive barking, especially barking caused by negative emotions such as fear or frustration.

Research by Zurlinden et al., (2022) which involved people passing through the kennels and tossing treats to the dogs no matter what the dogs did for 10 days, found that after an initial baseline period of 5 days, that the overall volume of barking reduced, fewer dogs barked over time, and individual dogs barked less over time. The most improvement was noticed in the afternoon.

### Environmental Enrichment

Environmental enrichment is the process of making an animal's living space interesting and stimulating so as to decrease boredom and its subsequent problems. It is important that species-specific enrichment is provided to ensure its relevance and efficacy. Enrichment is considered important to minimize the negative impacts of kenneling (Murtagh et al., 2020). Provision of environmental enrichment in the animal shelter environment can be an effective intervention to decrease barking, lower auditory stress and improve animal welfare (Garvey et al., 2017).

- Auditory enrichment Playing classical musical can reduce stress and promote more restful behaviours. It can also help mask other outside noise, such as that coming from the pistol club (Garvey et al., 2017).
- Olfactory enrichment Dog Appeasing Pheromone (DAP) is a synthetic version of a pheromone produced by females soon after whelping and it's known to have a calming effect, reducing problem behaviour in dogs (Garvey et a., 2017). Wells (2009) reported that seven days of exposure to DAP in the shelter environment decreased barking in dogs. Similar results were found by Tod et al., (2005) which showed that exposing shelter dogs to DAP for a seven day period reduced barking intensity and frequency. Sniffing and resting behaviour also increased following the exposure. Dap is available as a collar, diffuser or spray. Essential oils and other plant-based odours have also been found to be beneficial. For example Lavender and chamomile can help to reduce activity levels and vocalisations and to promote relaxation in shelter dogs. These forms of olfactory enrichment can be used

to reduce barking and reduce stress in dogs temporarily housed in the shelter or pound environment (Wells, 2009). Olfactory enrichment can also promote an increase in positive behaviours in the shelter environment (Murtagh et al., 2020). Sniff walks, during which dogs are taken for walks away from the kennel and allowed to sniff and explore at their leisure, are another form of olfactory enrichment which allows dogs to utilise their sense of smell and explore their environment.

- Feeding enrichment Research has demonstrated that the presence of food enrichment toys stimulates appetitive behaviours and increases the level of activity (exercise), measured in terms of time budgets and the total number of behaviours observed. Feeding enrichment also resulted in reduced barking frequency (Schipper et al., 2008). The provision of a relatively simple feeding enrichment toy appears to be a useful tool to stimulate appetitive and more variable behavioural patterns promoting the welfare of dogs housed in kennels.
- Training enrichment In kennel training sessions during which desired behaviour is positively reinforced with treats has been shown to reduce problem behaviour and increase desirable behaviours including sitting or lying down and being quiet as well as jumping up (Herron et al., 2014).

#### Physical barriers, low noise areas and noise abatement

Some dogs cope better in a shelter or kennel environment than others. For those dogs that become highly stressed or anxious, physical barriers that help reduce or prevent visual access to stressors (e.g. other dogs, people walking past, etc.) can help reduce their stress and anxiety and associate problem behaviour. Physical barriers could include tarps or thick curtains hung from kennel doors or walls or even a separate self-contained room (Garvey et al., 2017), kennel or area away from noise and triggers for those dogs who may benefit from some reprieve.

Should some dogs' behaviour deteriorate during pistol club operations due to the increased and prolonged noise, moving them to another room or area where the noise is decreased can be of benefit. The use of sound absorbing material in the shelter environment can also help to reduce auditory stress in shelter animals. Animal shelter, pound and kennel facilities are typically constructed of concrete walls and floors and metal or hard ceiling which, although easier to clean, do not absorb noise but reflect it. Sounds dampening materials, such as noise abatement paneling, hanging baffling and sound clips, can be incorporated into the kennel design and should be prioritised if possible (Garvey et al., 2017).

<u>Update – 28 July 2023</u>: I acknowledge the addition of acoustic panels atop the external kennels in the new design which is a welcomed addition. Ideally, the material selected should maximise noise absorption. I also acknowledge the updated acoustic report issued and the additional sound attenuation to the kennels.

The report also recommends two kennels in the rangers area and another two in the FOP area that will be fully enclosed. These will be used for the purposes of housing those dogs that are highly stressed or agitated by gun shots or other noises, which is an excellent mitigation measure.

Kennel construction requirements as outlined in the revised acoustic report include:

- The facility and kennels have been orientated to minimise noise emanating from the animals and noise impacting the facility from industrial noise and the pistol club.
- Listed management controls, kennel construction requirements and internal construction requirements as outlined in the Acoustic Report
- Futureproofing means are also highlighted in the report for sound attenuation over and above what has already been allowed, which is an added benefit.

### Cats housed separately to dogs

Dogs are known to be a source of stress and anxiety for cats in a shelter or pound environment. For this reason, cats should be housed away from dogs so that, ideally, they cannot see, hear or smell them. Cats should also be provided with hides as these have been shown to reduce stress and anxiety and increase social behaviour

#### Overnight foster programs

One of the greatest stressors for dogs temporarily living in animal shelters is social isolation. Getting them out of the shelter, even for just a day or two, can have measurable benefits to their behaviour and welfare. In a study by Gunter et al., (2019) dogs were temporarily fostered for one or two nights.

The results found that shelter dogs' urinary cortisol concentrations decreased and bouts of uninterrupted rest increased when the dogs were in foster homes. However the study concluded that although a reprieve from the shelter was positively impactful for the welfare of companion dogs, mitigating the stressors present in the shelter environment should also be addressed to improve the overall welfare of dogs.

#### Nutraceuticals and other calming aids

Several calming aids to address stress and anxiety in domestic pets have been developed however few have been tested scientifically for their efficacy. Of those currently available in Australia Zylkene has been found to be effective in reducing anxiety in cats (Beata et al., 2007) and dogs (Beata et al., 2007b) as reported by their owners. This treatment tends to be more effective for animals with mild anxiety. Anti-anxiety medication, prescribed by a veterinarian may be more appropriate for animals experiencing moderate to extreme or chronic anxiety.

The application of moderate to-deep pressure on soft tissue has been studied in both humans and nonhuman animals. Research has yielded positive results showing a reduction in anxiety and promotion of relaxation. Pressure wraps, such as the Thundershirt, have been designed specifically for dogs and has been shown to be beneficial as an adjunct to behaviour modification in reducing stress and anxiety in dogs (King et al., 2015).

Accurately reading and responding to animal behaviour and body language is an important aspect of ensuring optimal welfare. Ensuring staff who care for the animals are appropriately qualified

and trained in animal behaviour, body language, handling and training will help minimise stress and identify and address behaviour or welfare concerns promptly.

The recommendations outlined here are merely general guidelines and suggestions. Staff should make their own assessments of the needs, and most appropriate actions, for each individual animal under their care. A qualified Animal Behaviourist should be consulted should concerns about animal welfare or behaviour arise.

### 6. Responses to other follow up comment/queries after initial submission of this report

# - Comment on the Draft Operational Management Plan in relation to animal behaviour and welfare.

#### <u>Response</u>

I have read the Draft Operational Management Plan for the Murwillumbah Animal Rehoming Facility and acknowledge that in reference to Animal Welfare, the premises will operate in accordance with the applicable animal welfare standards and recommendations provided by me in this report. It may be beneficial for me to review this plan again in relation to animal behaviour and welfare prior to occupation of the facility for completeness.

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