Impact of Noise

Linking Health, Psychological Impacts of Noise to enforceable regulations / standards

Smart Noise Monitoring Technology

- Measures Decibel Levels (non certified)
- Automatic Filtering of Only-Relevant Noises
- Remote Connectivity
- Provides Legal Quality Reports
- Ranger Installed
- Usable for a range of complaint types

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Our Solution

Using an IoT approach we gather remote data, analyse both in the field and on our servers

Noise Monitor

Communications

NoiseNet Servers

Post Processing

Reports

Dashboards

Alerts

Generating insightful automated reports or via dashboards/alerts

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What we Deliver

Time	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
2/8/18							0.76	0	0	0	0.26	0.03	0.05	0	0.08
3/8/18	0	0.07	0	0.56	1.41	2.94	1.4	1.03	0.31	0.41	0.03	0.28	0.02	0	0.07
4/8/18	0.2	0	0.06	0.01	0.28	0.24	0.49	0.09	0.83	1.56	1.56	0.89	0.54	0.1	0.19
5/8/18	0.08	0	0.23	0.33	1.91	1.24	1.11	0.12	0.05	0.27	0.06	0.07	0.04	0.04	0
6/8/18	0.05	0.15	0.21	2.45	1.44	10.48	1	0.36	0.14	0.38	0.32	0.1	0.06	0	0
7/8/18	0	0.11	0.09	1.33	0.78	0.27	0.04	0.04	1.39	0.28	0.16	0.15	0.05	0	0
8/8/18	0.08	0.02	0	0.65	1.47	0.67	0	0.1	0	0.08	0.09	0.17	0.36	0	0
9/8/18	0.03	0.02	0.01	0	0.3	0	0.02	0	0.12	0	0.01	0.1	0	0.13	0
10/8/18	0.15	0	0.05	0	0	0	0	0.03	0	0.05	0.12	0.14	0.23	0.08	0
11/8/18	0.04	0.02	0.27	0.66	0.02	0.08	0.09	0.03	0.09	0.37	1.32	0.26	0.1	0	0.14
12/8/18	0	0	0.04	0.01	0.01	0	0	0	0	0.01	0	0	0	0	0
13/8/18	0.01	0	0.02	0.06	0	0	0	0.12	0.19	0.12	0.13	0.52	0.6	0.43	0.09
14/8/18	0	0	0.03	0.02	0	0.06	0.04	0	0.85	0.02	0.04	0.25	0.11	0.01	0.05
15/8/18	0.08	0.01	0.02												
Exceedances	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Total	1														

NoiseNet Certified Technology

- Same functionality as standard device

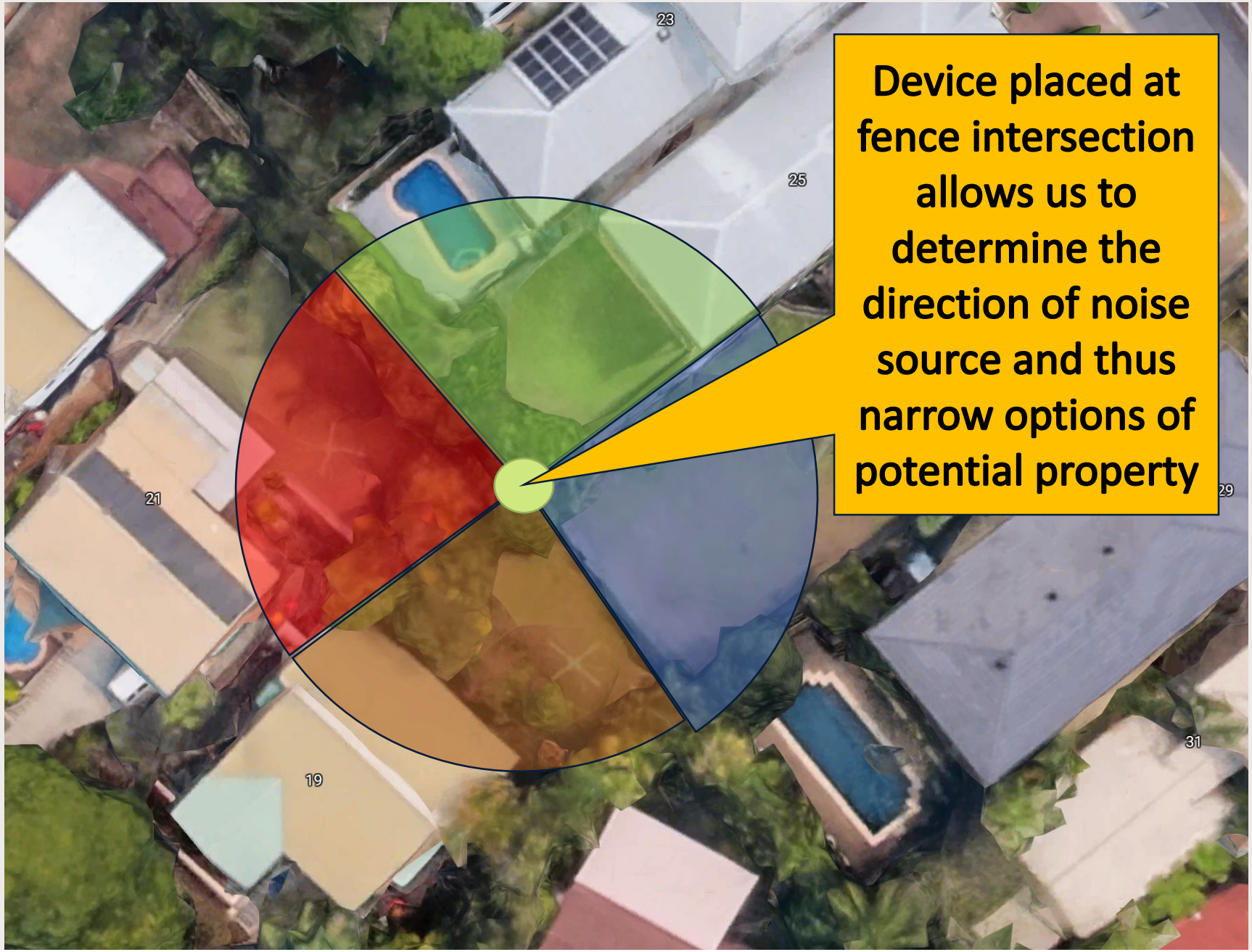
Plus

- Measures Decibel Levels (Certified)
- Shown here with TAMPER EVIDENT seal and cable tie

NoiseNet Directional Technology

- Array of 8 Microphones
- Provides directional information in addition to noise levels and audio
- Helping discriminate between sources of noise

Use of a directional unit to narrow source of noise.



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NOISENET "ARRAY"

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Other Applications in Local Government

- Environmental
  - Airconditioners
  - Pool Pumps
  - Construction Noise (start-times and excessive noise levels)
  - Entertainment or Business Noise
- Smart City
  - Parks Monitoring
  - Facility Usage
    - Skate-park
    - Tennis
    - Golf
  - Damage Detection
    - Broken Glass
    - Vandalism
  - Traffic Intensity

Talk to us if you have other ideas

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Winning the War on Noise Complaints

We want to be able to resolve real complaints quickly and efficiently.

We don’t want time wasted on marginal or even malicious complaints

Noise is a Precise Science.

- It is complex and human impacts are not precise
- Human Impacts at multiple levels
  - Intensity, distance duration, time of day, irritation and personal responses
- Health Impacts are Real - peer reviewed science is growing
- Conclusion is that Noise is a real impactor on health affecting a wide range of health measures:
  - Stress / hypertension
  - Certain Cancers
  - Heart Disease
  - Hearing Loss
  - Type 2 Diabetes
  - ……

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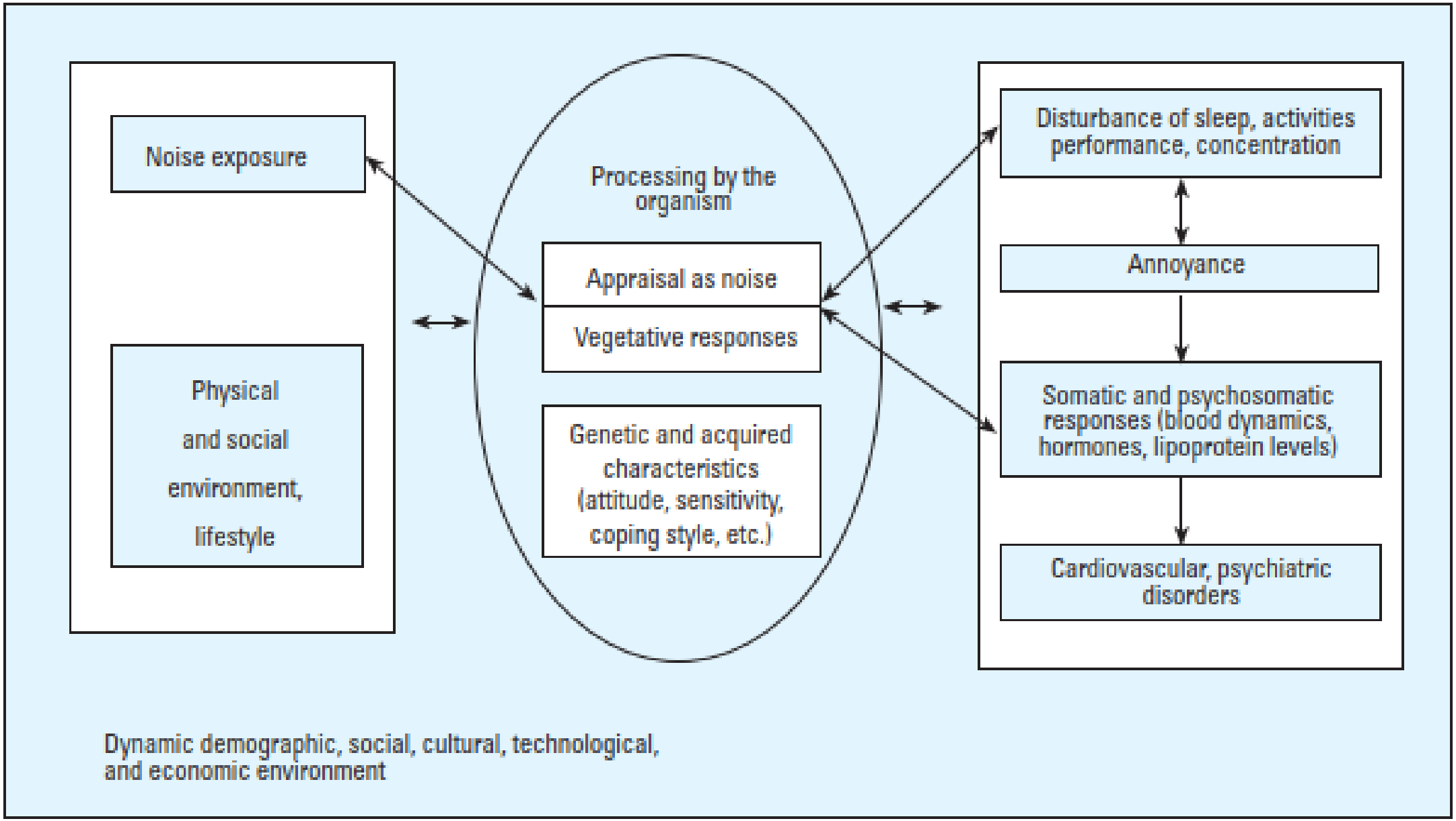


Figure 1. Conceptual model of the interaction of noise with humans and the occurrence of effects on health and quality of life (*2*).

Is Noise the New Smoking??

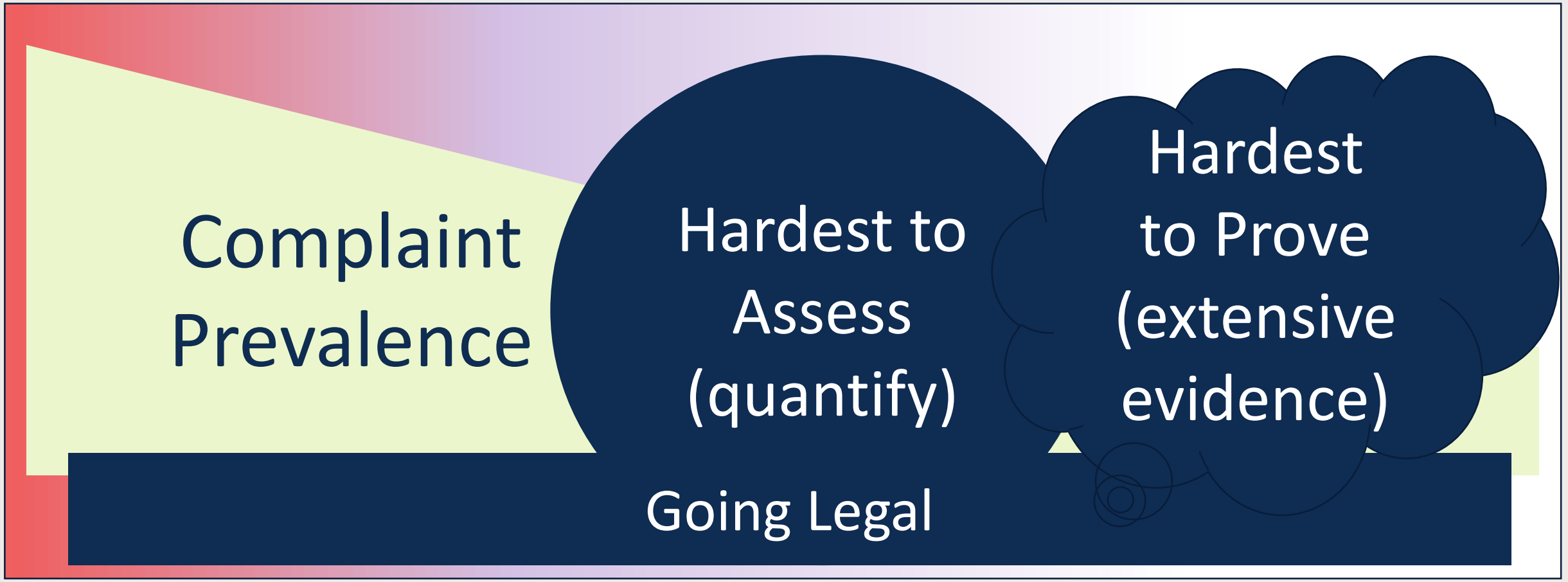
- No, noise is not damaging the body, noise is weakening defences and repair mechanisms.
- Body has natural circadian cycle (awake, rest, light sleep, deep sleep)
  - Cycle of reducing stress hormones, increasing relaxation hormones.
  - Progression from light into deep is CRITICAL
  - This is where the body switches on its repair processes
    - Fixing damage from day before
    - Removing inflammation
    - Fighting infections and removing dead or defective cells
  - LOSS OF DEEP SLEEP doesn't just cause fatigue. It hinders your regeneration, which over time has major health impacts.
- But Noise is a REAL ISSUE impacting on physical and mental health

So as regulators you are policing this real harm, and your regulations?

- SA: "If a dog either alone or … which persistently occurs or continues to such a degree or extent that it unreasonably interferes with the peace and comfort of another person"
- Victoria: "persistently or continuously disturbs a neighbor"
  - Generally leaving it to the complainant to enforce through courts
- Queensland: "barks excessively"
  - Translated to 6min/hr day 3min/hr night and 50% of councils
- NSW: "that persistently occurs or continues to such a degree or extent that it unreasonably interferes with the peace, comfort or convenience of any person in any other premises"
- WA: "a dog persistently barks in a manner to such a degree or extent that it unreasonably interferes with the peace, comfort or convenience of any person"

Unhelpful

Difficulty of Resolution



Extreme Significant Present Mild Occasional None

So is there a way forward?

SCIENCE	• **Science of Noise** • **Science of Health / Interruption / Disturbance**
CRITERION	• **Consistent Definitions** • **Consistent Measurement/ Interpretation** • **Preferably Regulated (guidelines as stopgap)**
EVIDENCE GATHERING	• **Conventional (or manual) techniques with** • **Technology**
Making management of noise complaints easier, improving clarity and thus legal success	

The Science

Nothing yet on dogs. So we work with other noise nuisance.

Determining what really does impact on health and wellbeing

Dogs compared with other noise sources

Noise Source	Intensity dB(A)	Event duration	Frequency	Cycles
Dogs	Up to 100	.5 second	Up to 15 min/hr/animal	Daily cycle (variable)
Traffic	Up to 80-90	5 seconds	Infrequent to continuous	3 minutes (traffic lights) and daily cycle (consistent)
Aircraft	Up to 90	Up to 90 seconds	Up to 30 events/hr	Daily cycle (weather/ season dependent) Curfews in some locations
A/C Pool pump	Up to 10 above background	1min to continuous	Cycling typically 3-30 minutes	Very seasonally based.

- Traffic Noise regulated by total noise energy LEQ
- Aircraft regulated by typical event noise level plus number of events
- Mechanical noise, measured as level above background by day/night
- **Dogs closest to Traffic / Aircraft**

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Medical impacts - differential

- 5dB(A) Increase
  - 14% higher hypertension level from road noise
  - 9% higher risk of isochemic heart disease (road noise)
  - 26% higher hypertension level from aircraft noise
- 10dB(A) Increase
  - 23% higher reporting of general ill health
  - 72% higher usage of prescribed sleep medications (late evening noise)
  - 30% higher use of medications for heart disease / blood pressure
  - 132% higher use of non-prescribed sleep medications

Source:
Franssen, E, et al. Aircraft noise around a large international airport and its impact on general health and medication
Elise,E and Kempen, K. The association between noise exposure, blood pressure, ischemic heard disease a meta-analysis

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Medical impacts – absolute noise levels

- 115 – Hearing loss (HL) results within 30 seconds exposure
- 110 – HL in 2 minutes
- 100 – HL in 15m
- 90 – HL in 2h
- **85 – HL in 8h a normal work shift**

- 55 – Adverse health effects from rail or traffic noise by day

- 45 – Adverse health effects from rail or traffic noise by night or aircraft by day
- 40 – Adverse health effects from aircraft by night

Measure: dB(A) Level equalised over stated period
Source: NIOSH-AINSI and aligns with Australian OHS act
World Health Organisation

Medical impacts - waking

- So-far waking has been assessed in terms of ‘average noise levels’
- Clearly from the chart on the right, that same transition of 45-55dB goes from 2-3 waking events per month, to EVERY NIGHT.

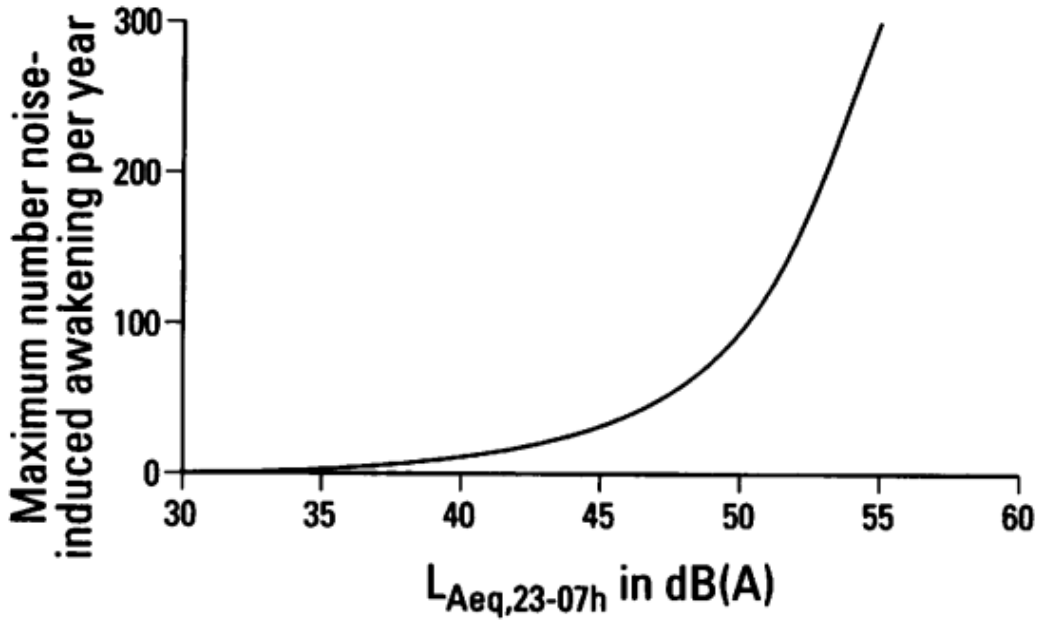

Figure 4. The maximum number of awakenings per year as a function of the outdoors night-time equivalent sound level (*8*).

Source:
F Franssen, E, et al. Aircraft noise around a large international airport and its impact on general health and medication

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What does this mean for Authorised Persons in terms of dog-barking

- Three key components:

1. Number of Waking Events (during sleeping hours, sufficiently loud/prolonged to wake a normal person) relative to background noise.

2. Noise Energy associated with nuisance (combination of duration and noise intensity) relative to background noise and in absolute terms.
   - Measured over a shorter duration (hour by hour) plus
   - Overall daytime period

3. Consideration of situation of complainant/community
   - Proximity between animal/property and
   - Health issues, shift work, children/parents/retirees at home all day

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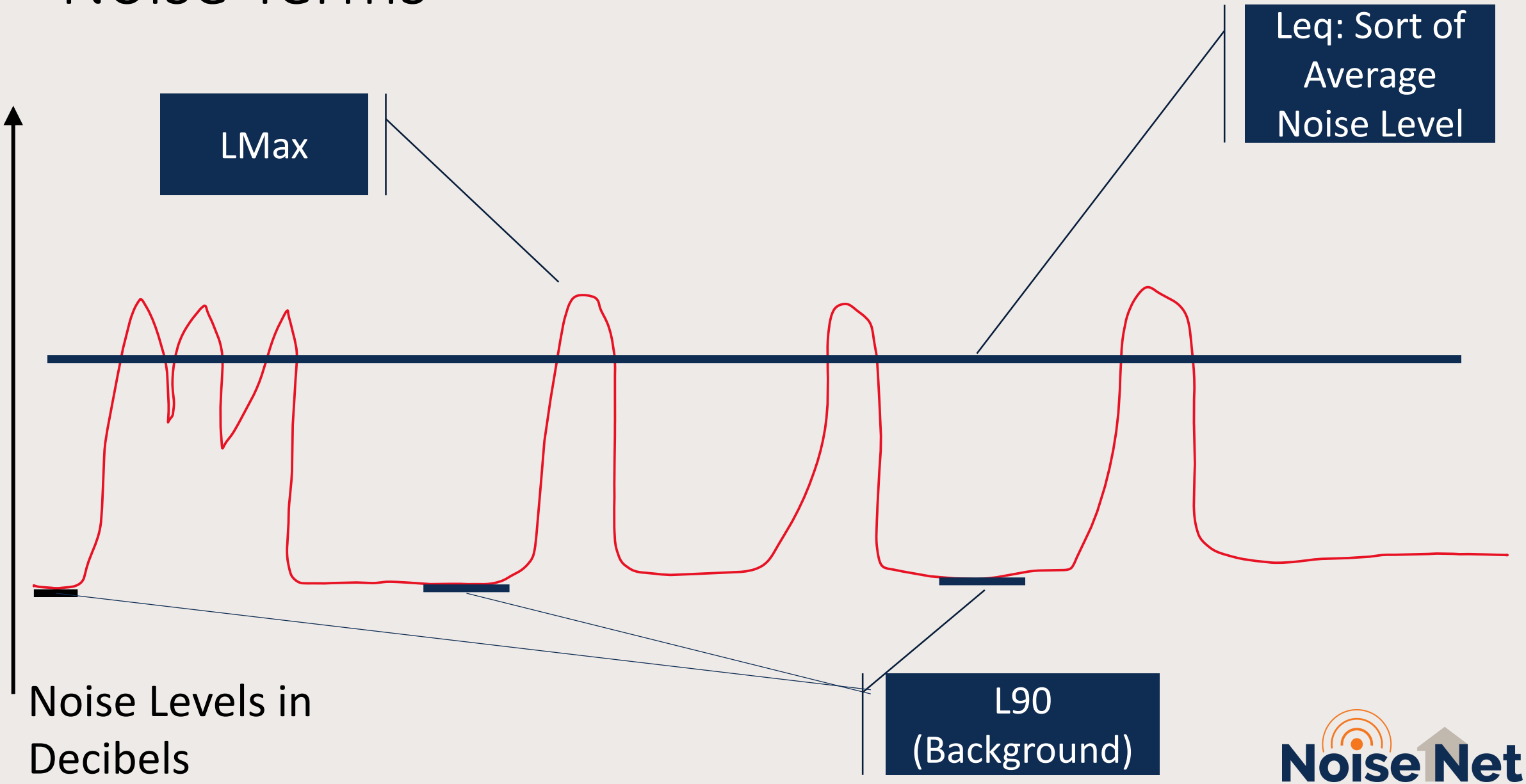
The Criterion

Consistent Measurement

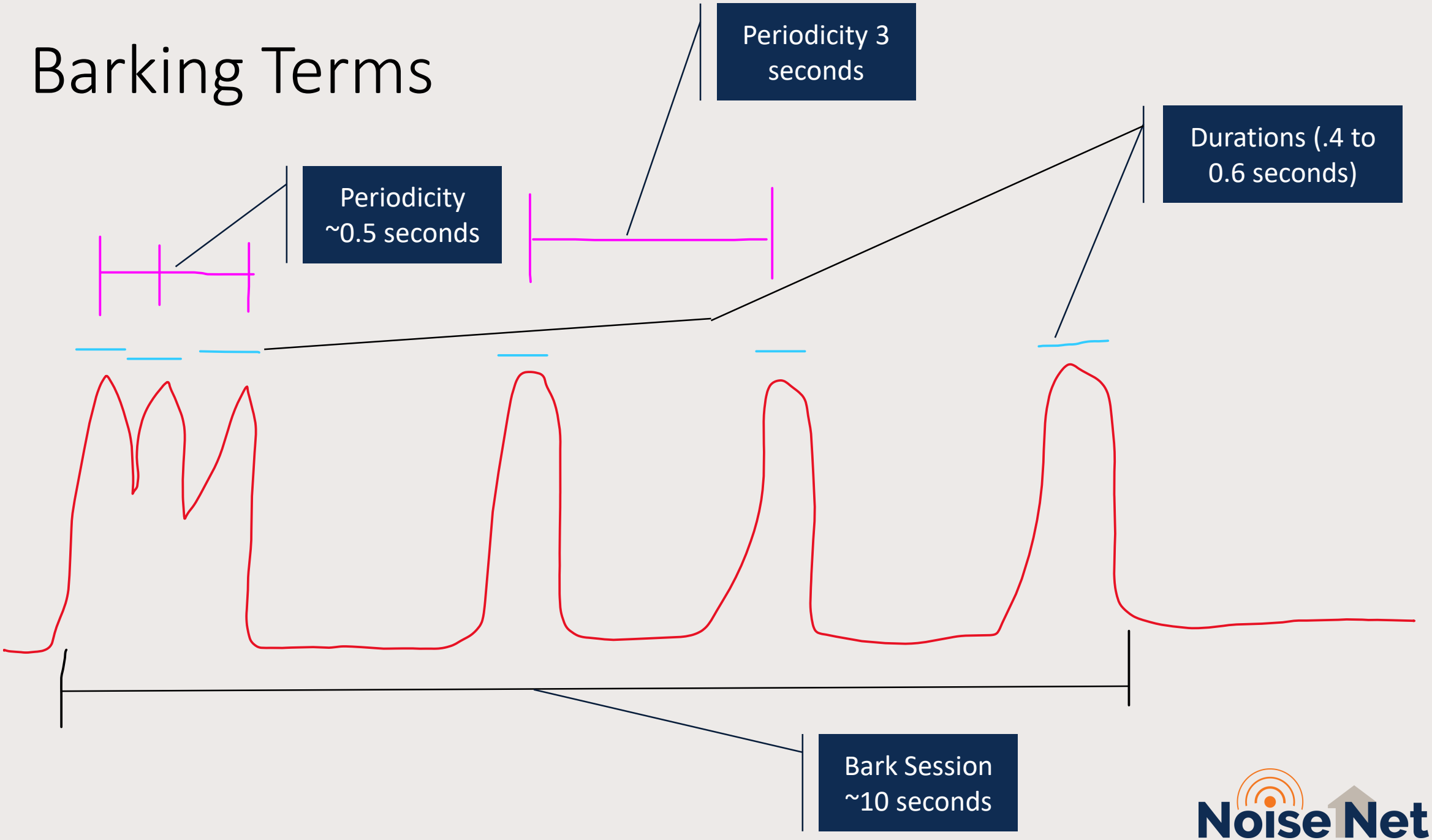
Clear Definitions and

Consistent Interpretation

Noise Terms


LMax
Leq: Sort of Average Noise Level
Noise Levels in Decibels
L90 (Background)

Barking Terms



Bark Frequency/Duration/Intensity

- A single dog can only achieve 15-20 minutes of barking in an hour
  - This is very extreme (the dog needs to breathe in between barks)
  - The 6/3 minute criterion used in some jurisdictions is still a lot of barking
- Duration alone is misleading as it ignores intensity / time of day
  - Hour by hour has benefits for measurement, but can still be extreme
- Defining Bark Intensity:
  - Levelised Noise Energy of BARKS, relative to background level
  - Modified by the duration of the noise (+3 for doubling of duration)

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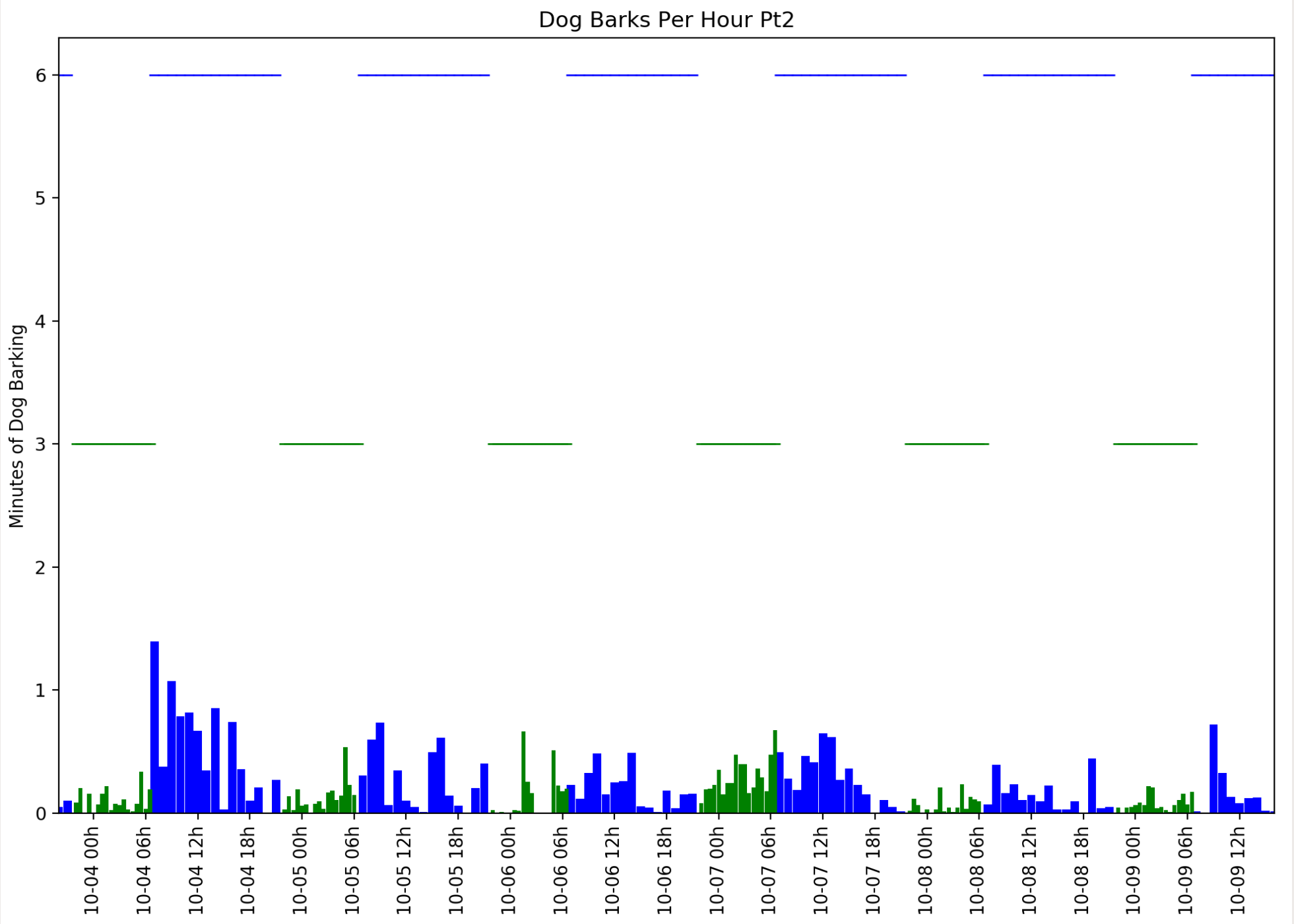
Examples


Dog Barks Per Hour Pt2
Minutes of Dog Barking
0
1
2
3
4
5
6
10-04 00h
10-04 06h
10-04 12h
10-04 18h
10-05 00h
10-05 06h
10-05 12h
10-05 18h
10-06 00h
10-06 06h
10-06 12h
10-06 18h
10-07 00h
10-07 06h
10-07 12h
10-07 18h
10-08 00h
10-08 06h
10-08 12h
10-08 18h
10-09 00h
10-09 06h
10-09 12h

A starting point for a Standard

- More than 2 waking events per night
  - Waking Event Defined as Bark Intensity > ~7 (in each/any 30 minute duration)
  - Equivalent of 3 minutes barking at 5dB over background
- Daytime Hourly Bark Intensity > ~18
  - For each daytime hour, equivalent to 6 minutes barking at 10dB(A) over background
- Daily Bark Intensity > ~25
  - Over the 16 hours of daytime: 6am to 10pm
  - Equivalent to 6 minutes of barking in 5 hours at 10dB(A) over background

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Evidence Gathering

Combination of approaches to get:

- Best quality evidence quickly and affordably

NoiseNet Technology gives us the power to assess all these relatively easily

- 24/7 monitoring of noise levels, background and impulsive
- Ability to differentiate between different noise types
- Automation of processes allows both short and longer term monitoring so conclusions are soundly based.

- Offers the Authorised Person the ability to review real data, compare against criterion and make an evidence based decision.

  - We are currently incorporating noise levels into our standard analysis process
  - First demonstration was on a job for Port Adelaide Enfield

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Assessment without technology

- Field visits and doorknocks can assess severity against this same criterion on a qualitative basis:

1. How loud is the dog? Measure it and how far will it be from the point it creates a nuisance. Ask neighbours how loud (extreme, very, loud, moderate, quiet)…
2. Assess/ask about barking during night. "How often are you woken by the animal at night?". "Does the dog do one-off barks, or prolonged barking sessions at night?"
3. Assess/ask about barking during the day: Use a structured approach in diaries (number of barks in succession, periodicity, duration of "sessions")

Providing a consistency of approach to "Authorised Person Judgement" regardless of whether using monitoring or not.

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Manual Tools

- Use for diary assessment
- During interviews
- Field observation
- Gathered data

BARK INTENSITY CALCULATOR

		DURATION MEASURED								
Qualitative Loudness	Relative to Background	8 sec	15 sec	30 sec	1 min	2 min	4 min	8 min	16 mins	32 mins
Painfully Loud	+20 dB(A)	11	14	17	20	23	26	29	32	35
Very Loud	+15 dB(A)	6	9	12	15	18	21	24	27	30
Loud	+10 dB(A)	1	4	7	10	13	16	19	22	25
Fairly Loud	+5 dB(A)	0	0	2	5	8	11	14	17	20
Audible	0 dB(A)	0	0	0	0	3	6	9	12	15
Barely Audible	-5 dB(A)	0	0	0	0	0	1	4	7	10

- Also Apply Modifiers for distance/buildings/etc

Manual Tools

- Actually quite uncomplicated.
- Use for diary assessment
- During interviews
- Field observation
- Gathered data

BARK INTENSITY CALCULATOR

Attenuation Modifiers	Outside	Very Open	Open Windows	Closed Timber/light	Heavy/ insulated
where is the person affected	0	-2	-3	-6	-10

-3

Distance MODIFIERS	Half	As Measured	x2	x4	x8	x16
Receptor relative to measuring point	+3	0	-3	-6	-9	-12

-3

Additional Animals	As Measured	x2	x4
where the additional animals are equally loud to that assessed	0	+3	+6

3

-3

		DURATION MEASURED											
Qualitative Loudness	Relative to Background	8 sec	15 sec	30 sec	1 min	2 min	4 min	8 min	16 mins	32 mins	1 hour	2 hours	4 hours
Painfully Loud	+20 dB(A)	11	14	17	20	23	26	29	32	35	38	41	44
Very Loud	+15 dB(A)	6	9	12	15	18	21	24	27	30	33	36	39
Loud	+10 dB(A)	1	4	7	10	13	16	19	22	25	28	31	34
Fairly Loud	+5 dB(A)	0	0	2	5	8	11	14	17	20	23	26	29
Audible	0 dB(A)	0	0	0	0	3	6	9	12	15	18	21	24
Barely Audible	-5 dB(A)	0	0	0	0	0	1	4	7	10	13	16	19

Noise Criterion	Night Rating (30 mins)	10
	Modifiers	-3
	Overall	7

1 hour Exceedance	22
Modifiers	-3
Overall	19

Daytime Exceedance	34
Modifiers	-3
Overall	31

Noise Criterion	WAKING EVENT	No
	Over a 30 min period 10pm-6am	

1 hour Exceedance	Yes
Over a single hour of measurement	
Prorata	

Daytime Exceedance	Yes
Total duration 6am-10pm	
Prorata	

Location:

Date: 24/05/2019

Start Recording

Recording Duration 11:30 AM hours

End Recording 11:30 AM

End date 24/05/2019

Form Completed by:

Signature:

Ranger in Attendance:

Signature:

Complainant	Witness