



Department of  
Environment and Conservation

# **EPA GUIDANCE NO. 8 ENVIRONMENTAL NOISE**

**Draft for public and stakeholder review**

**Seminar**

**Presented by  
Environmental Noise Management  
and SVT Engineering Consultants**

**25 June 2007**





## Overview

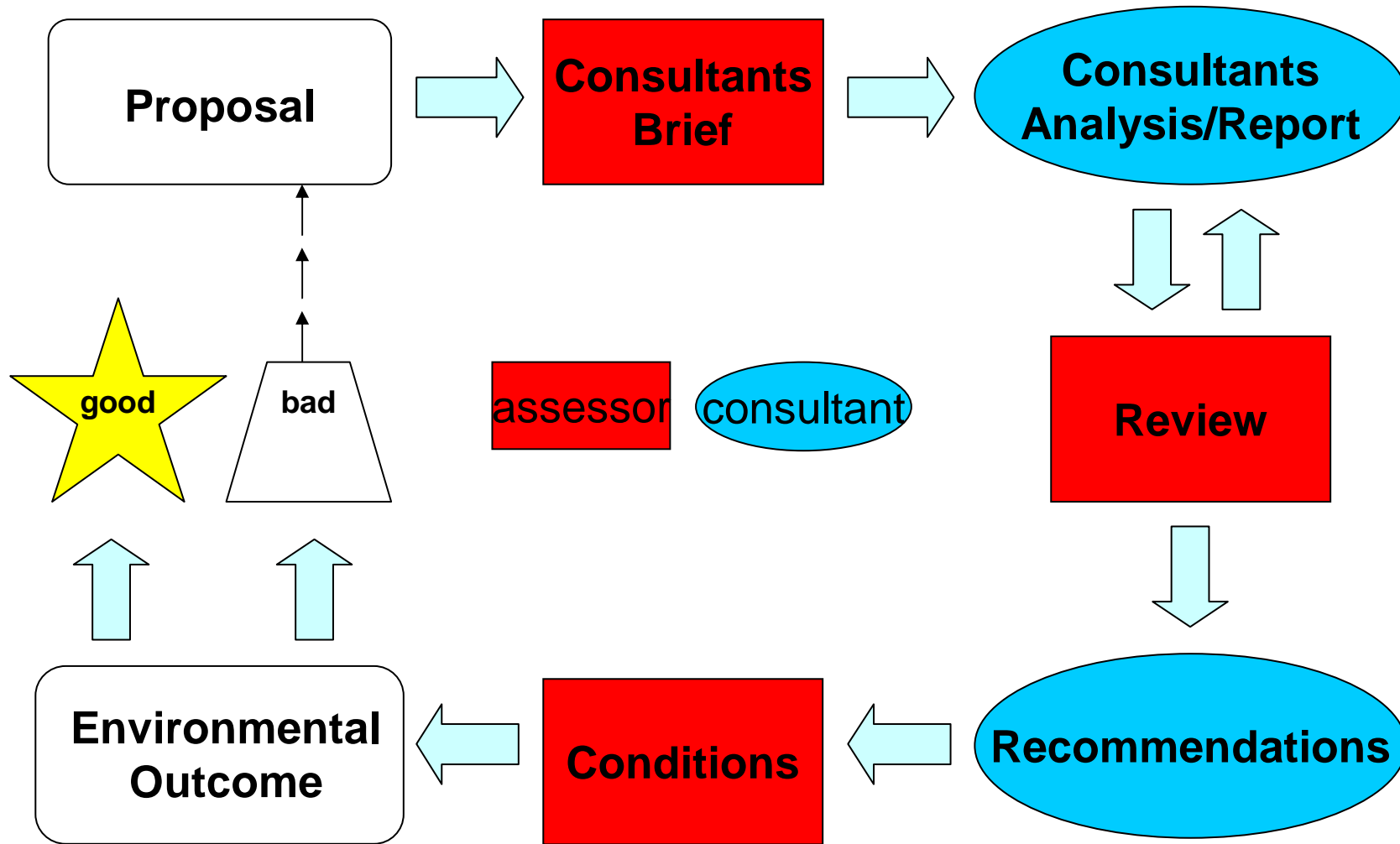
- Development of Guidance 8
- EPA policy additions
- Screening procedure
- Noise modelling
  - Default conditions for modelling
  - Comparison of ENM and SoundPlan
- Reporting noise assessments





# Guidance 8 arose from the need for consistency and certainty in the EPA's assessment of proposals involving noise







## Guidance 8 – Purpose and Objectives

- Purpose –

- Protect the noise environment
- Ensure proposals meet relevant noise/vibration standards
- Provide certainty in EPA process
- Present EPA position to stakeholders

- Objectives –

- Significant noise impacts identified and addressed in a consistent manner
- Proposal can be managed to meet noise regulations and acceptable standards
- Continuous improvement and ALARP principles





## Guidance 8 – Scope

- Addresses noise from premises or public places –
  - Proposals required to meet noise regulations
  - Proposals required to meet other acceptable standards but excluding transport noise
- Transport noise not included –
  - Road and rail noise – draft State Planning Policy
  - Proposal increases traffic – EPA Guidance 14 (preliminary)
  - Aircraft noise – Perth and Jandakot: State Planning Policies
  - Regional airports – future EPA Guidance



## Guidance 8 – 1998 draft

- Defined “worst case” for noise prediction –
  - Worst 2% of worst month
- Default meteorological conditions –
  - Day: 4m/s wind
  - Night: 3m/s wind and 2degC/100m temperature inversion
  - Based on Cullacabardee data
  - Alternative conditions based on site-specific met. data
- Screening procedure
- Reporting requirements





## DOIR/SKM Review of 1998 Guidance

- Is Cullacabardee data representative of WA?
  - Collie and Kwinana – yes
  - Coastal areas no inversion for onshore winds
  - Arid areas?
- Are the worst-case conditions based on site-specific data workable?
  - Not really
  - Removed from 2007 draft Guidance







## 1998 Guidance review – SVT model comparison

- Do ENM and SoundPlan predict the same levels?
  - Treat meteorological conditions differently
  - ENM predicts slightly higher levels, especially with barrier
- Default conditions for SoundPlan?
  - Day: Pasquill Stability Factor – “E”
  - Night: Pasquill Stability Factor – “F”





## 1998 Guidance review – EPA policy positions

- **Proposals needing to meet assigned levels**
  - Cumulative noise assessment
  - Non-compliance with assigned levels
  - Planning for new residential developments
- **Proposals meeting other acceptable standards**
  - Construction noise
  - Wind farms
  - Sporting/entertainment facilities
  - Ground vibration
  - Indoor noise levels



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# New draft Guidance 8 – May 2007



Environmental Protection Authority

## Guidance for the Assessment of Environmental Factors

(in accordance with the  
Environmental Protection  
Act 1986)

## Environmental Noise

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## Guidance 8 – EPA policy positions – Proposals needing to meet assigned levels

- **Cumulative noise assessment**
  - Cumulative noise should meet assigned levels
  - If assigned levels already exceeded, must meet the “5dB below” requirement of reg 7(2)
  - If exceedance is from wind, fauna, ocean, traffic, then don’t need to meet “5dB below”
  - Large industrial estate, proposal should meet a target below the “5dB below” with objective that cumulative noise emission meets assigned level
  - Planning for large industrial estates: notional 3km buffer





## Guidance 8 – EPA policy positions – Proposals needing to meet assigned levels

- **Proposal causes increase in assigned levels**
  - Assigned levels determined by influencing factor (IF)
  - Proposal may introduce new “Industrial” land into 450m radius, increasing IF
  - Proposal could then meet the new assigned level but still cause impact
  - EPA position is that increase in IF should be identified as part of impact of proposal
  - Noise emissions should be below new assigned level, as far as practicable





## Guidance 8 – EPA policy positions – Proposals needing to meet assigned levels

- **Non-compliance with assigned levels**
  - EPA mindful of impacts, especially health impacts
  - Proposal for upgrade of existing non-compliant plant –
    - Provide Noise Improvement Plan
    - New plant should by itself be below assigned levels
  - If can't practicably comply, apply under noise reg 17
    - Minister's approval to exceed assigned levels
    - EPA will assess reg 17 in parallel with Part IV





## Guidance 8 – EPA policy positions – Proposals needing to meet assigned levels

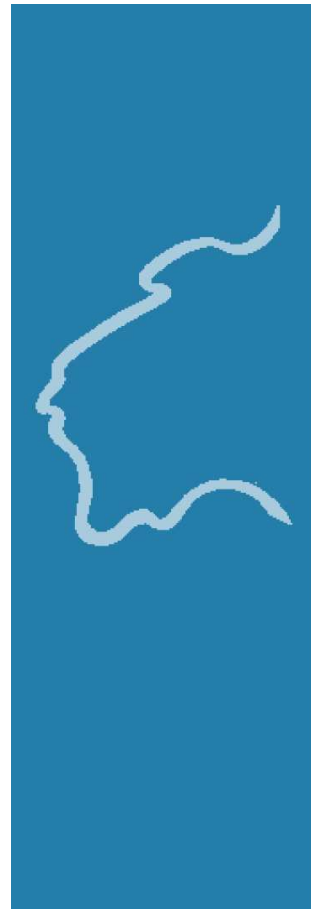
- **Planning proposals new residential areas**
  - EPA will provide advice rather than formally assess
  - Buffers should allow industry to comply with minimum industry footprint
  - Buffers should be robust – ideally owned by Industry
  - If existing industries can't practicably comply, then design development so indoor and outdoor noise complies, as far as practicable





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# EPA Policy – other acceptable standards



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## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- **Construction noise**
  - Comply with assigned levels where practicable
  - If can't comply, use noise reg 13 as basis
  - Activities that EPA regards as construction work –
    - Erection of barrier/earth bund for noise
    - Topsoil removal to 5m depth, except if topsoil is a product
  - Removal/dumping of overburden is not construction work





## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- **Wind farms**
  - May need to assess noise at wind speeds  $>4\text{m/s}$  “worst case”
  - Noise generation may increase with wind speed
  - Assessment should be done to South Aust Guidelines –
    - Measure ambient noise at a range of wind speeds
    - Correlate ambient noise with wind speed
    - Predict wind farm noise at range of wind speeds
    - Wind farm noise  $<35\text{dB(A)}$  or  $5\text{dB}$  above ambient





## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- **Sporting and entertainment facilities**
  - Facilities for motor sports, shooting and concerts
  - EPA recognises that noise reg amendments are in process to address these types of facilities
  - EPA may recommend Ministerial Conditions that differ from the noise regs as interim measure
  - Conditions would require a Noise Management Plan –
    - Number /times/types of events
    - Noise limits and control measures
    - Community complaint and information procedures





## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- Ground vibration
  - “Noise” includes vibration
  - May be perceived as “shaking” or “regenerated noise”
  - Building damage is a civil – not environmental – matter
  - Guidance 8 sets some criteria for blasting –
    - Day: 10mm/s any blast, 5mm/s for 9 out of 10 blasts
    - Night: 1mm/s any blast, 0.5mm/s for 9 out of 10 blasts
    - Community complaint and information procedures
  - Construction/industrial should meet AS2670.2 Annex A



## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- **Indoor noise levels**
  - Mainly relates to –
    - planning proposals;
    - noise insulation is to be provided for noise-sensitive buildings; and
    - assigned levels under noise regs don't apply.
  - Example: new residential near major concert venue
  - Indoor noise should meet “satisfactory” level in Table 1 of AS2107:2000
  - Exception that  $L_{Aeq}$  (average) level in bedrooms <35dB(A)



## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- **Natural quiet**
  - Protection of important places of quiet
  - EPA may set an “aspirational goal” noise level
  - Example of Hearsons Cove on Burrup Peninsular
  - Goal would consider –
    - Environmental value of the area
    - Existing ambient noise levels
    - Human/animal activities in the area
    - Risk that noise immissions would be intrusive





## Guidance 8 – EPA policy positions – Proposals meeting other acceptable standards

- Impacts on animals
  - EPA concern about impacts on rare/threatened species
  - EPA notes –
    - There is limited research data on noise and animals
    - Many animals appear to habituate to noise
  - Precautionary approach based on risk assessment –
    - Identify animal populations at risk
    - Conduct risk assessment to estimate likelihood of impacts
  - Example: Woodside Scott's Reef seismic test proposal





## Guidance 8 – EPA policy positions – General policy requirements

- Special considerations for residences
  - EPA will assess residences as follows –
    - Unoccupied but habitable – need to comply
    - Occupiers absent by agreement – no need to comply
    - Owned by proponent but sub-let – need to comply
    - Sub-let to employee – meet goal for construction camps
  - Construction camp on same premises as proposal –
    - Goal for sleeping areas:  $L_{A 10}$  40dB(A),  $L_{A \max}$  50dB(A)
  - Construction camp on separate premises: use reg 13





## Guidance 8 – EPA policy positions – General policy requirements – consultation

### Community must be consulted –

Before and during Part IV assessment

Technical data will be presented clearly and accurately

Community concerns documented and addressed



### Concurrent reg 17 application, community understands –

Noise reduction measures already done/in progress

Noise limits being applied for

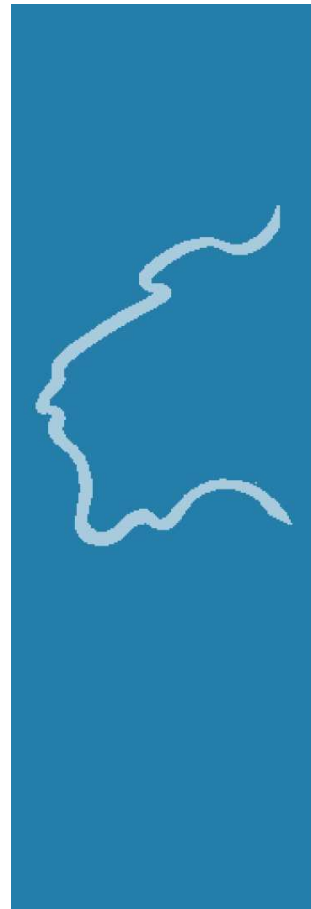
They have input into noise ameliorative measures





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## Guidance 8 – Detailed assessment of noise



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## Guidance 8 – Noise Modelling

### Why Model?

- Reliable measurements cannot be readily obtained.
- Predictive tool for EIA and land use planning
- Assess impact on a number of receivers.
- Compare noise reduction scenarios.
- Investigate meteorological effects.





## Noise Modelling Inputs – the sources

- Shape – point, line (conveyor) or surface (wall/roof)?
- Directivity – radiates sound equally in all directions?
- Spectrum – energy at high or low frequencies?
- Sound power levels – average or maximum values?
- Location on the map and height above ground
- Complex sources may be split into several components





## Noise Modelling Inputs – the site

- Natural topography
- Man-made changes – mining pits, overburden dumps
- Noise barriers – noise walls, buildings (not trees!)
- Ground absorption – hard (reflective) or soft (absorptive)





## Noise Modelling Inputs – meteorological data

- Temperature
- Humidity
- Wind speed
- Wind direction (or all directions at once)
- Temperature inversion strength or stability factor
- “Surface roughness” (affects wind gradient)





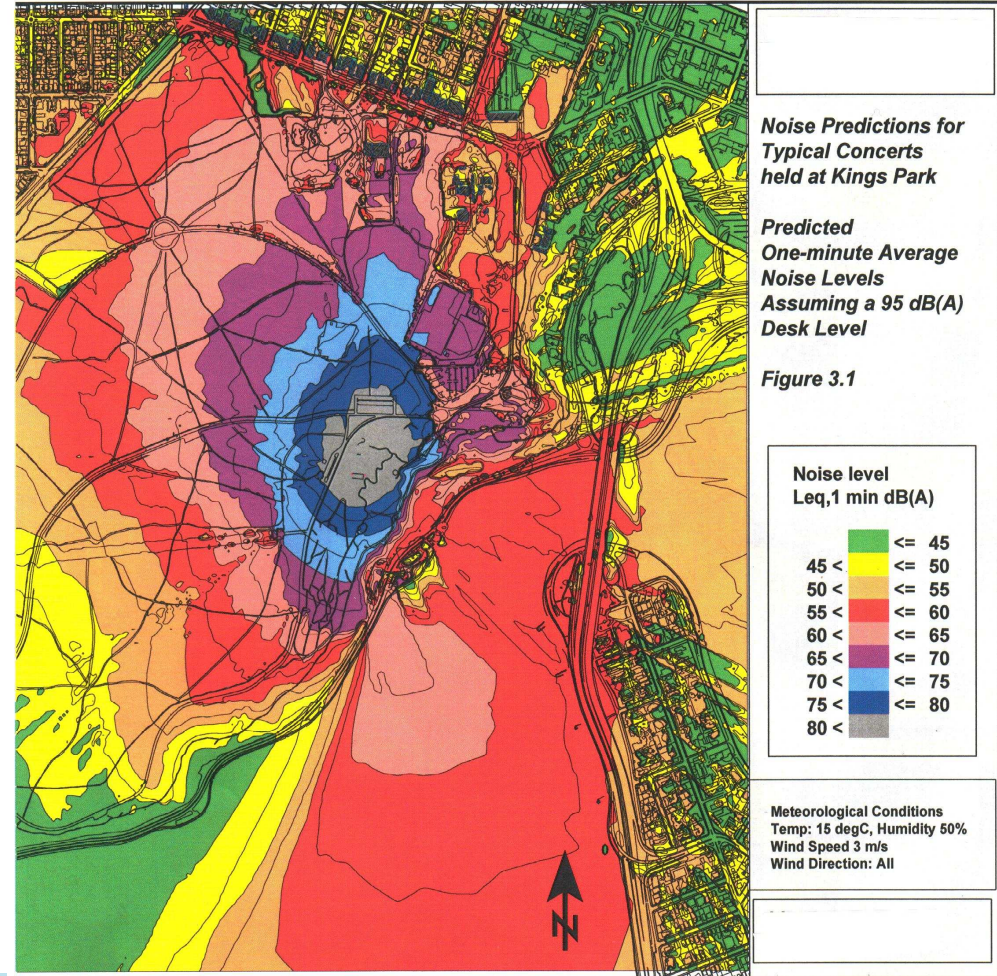
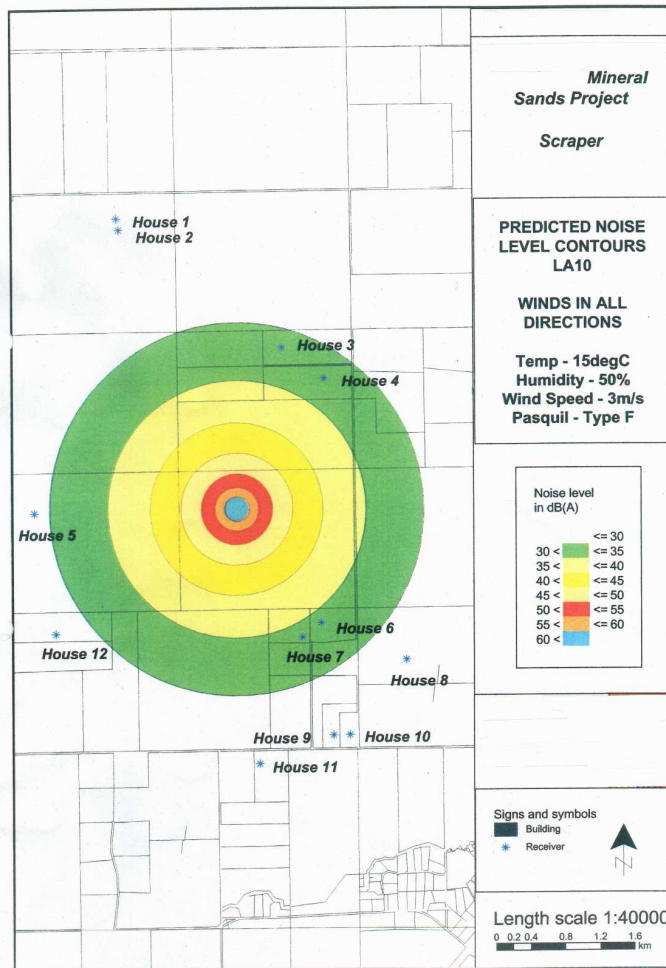
## Noise Modelling – sound propagation factors

- **Distance** (6dB per doubling of dist from point source)
- **Air absorption** (greater at higher frequencies)
- **Wind speed** (propagation increases with speed)
- **Wind direction** (downwind vs upwind)
- **Temperature gradient** (positive gradient enhances propagation due to downward bending)
- **Ground absorption** (negated by temperature inversion)
- **Barrier attenuation** (negated by temp inversion)





# Simple and Complex noise modelling







## Noise modelling – Implications for Guidance 8

- Need recognised, skilled person
  - AAS or AAAC member
- Recognised acoustic modelling software
  - ENM and SoundPlan most common in WA
- Consistent meteorological conditions for model
- Well-documented report





## 1998 Guidance – Default meteorological conditions

- Defined “worst case” for noise prediction –
  - Worst 2% of worst month
- Default meteorological conditions –
  - Day: 4m/s wind, no temp inversion
  - Night: 3m/s wind and 2degC/100m temp inversion
- Site-specific data could be used –
  - For worst month, select % downwind incidence “I”
  - Model for speed  $V = I - 2$  m/s, up to 4m/s day or 3m/s night
  - Model temp inversion  $T = 5 - V$  degC/100m



## Guidance 8 – Default meteorological conditions

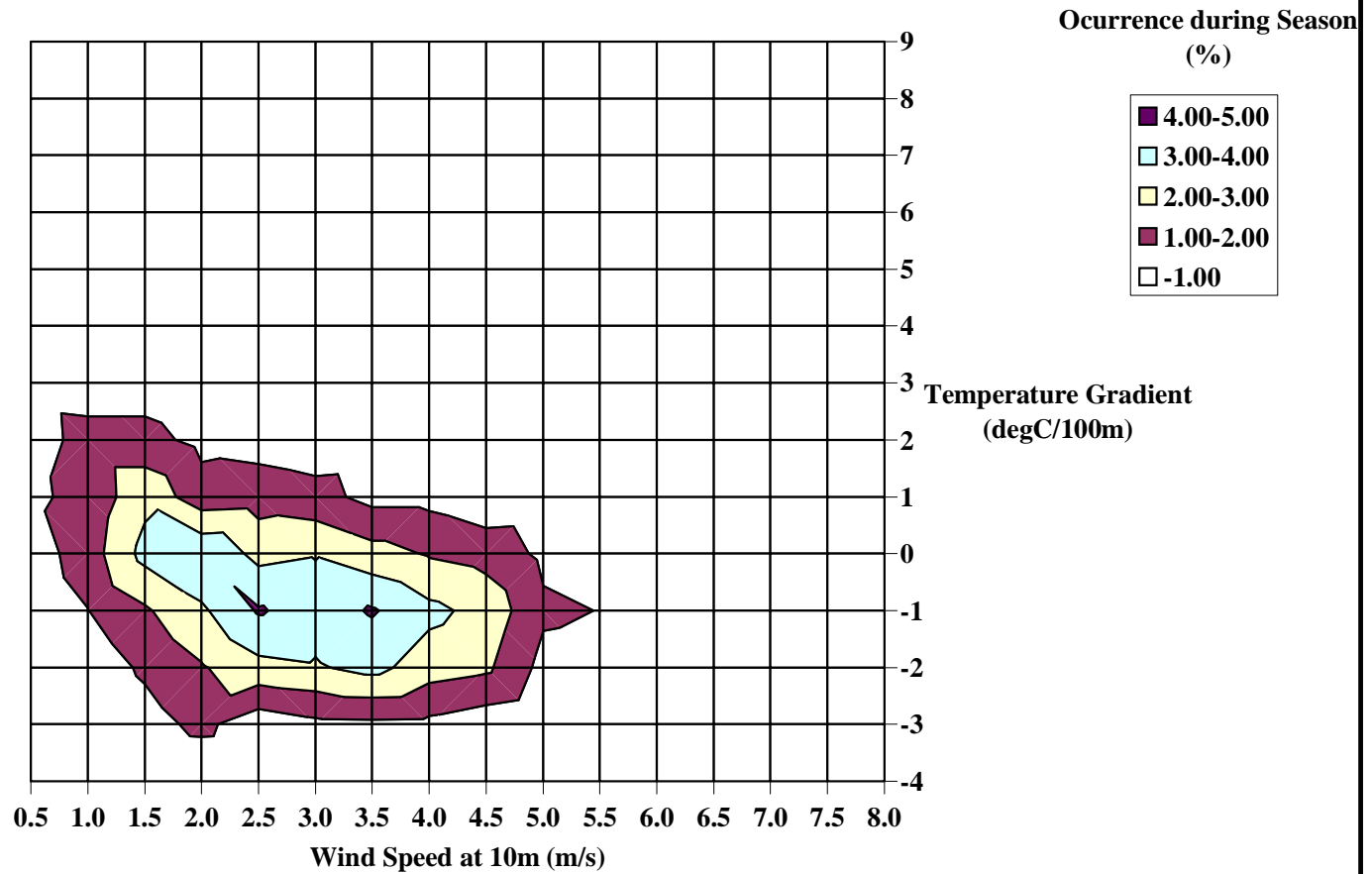
Where did they  
come from and  
are they  
representative  
of WA?





# 1998 Guidance – Cullacabardee data – Winter/day

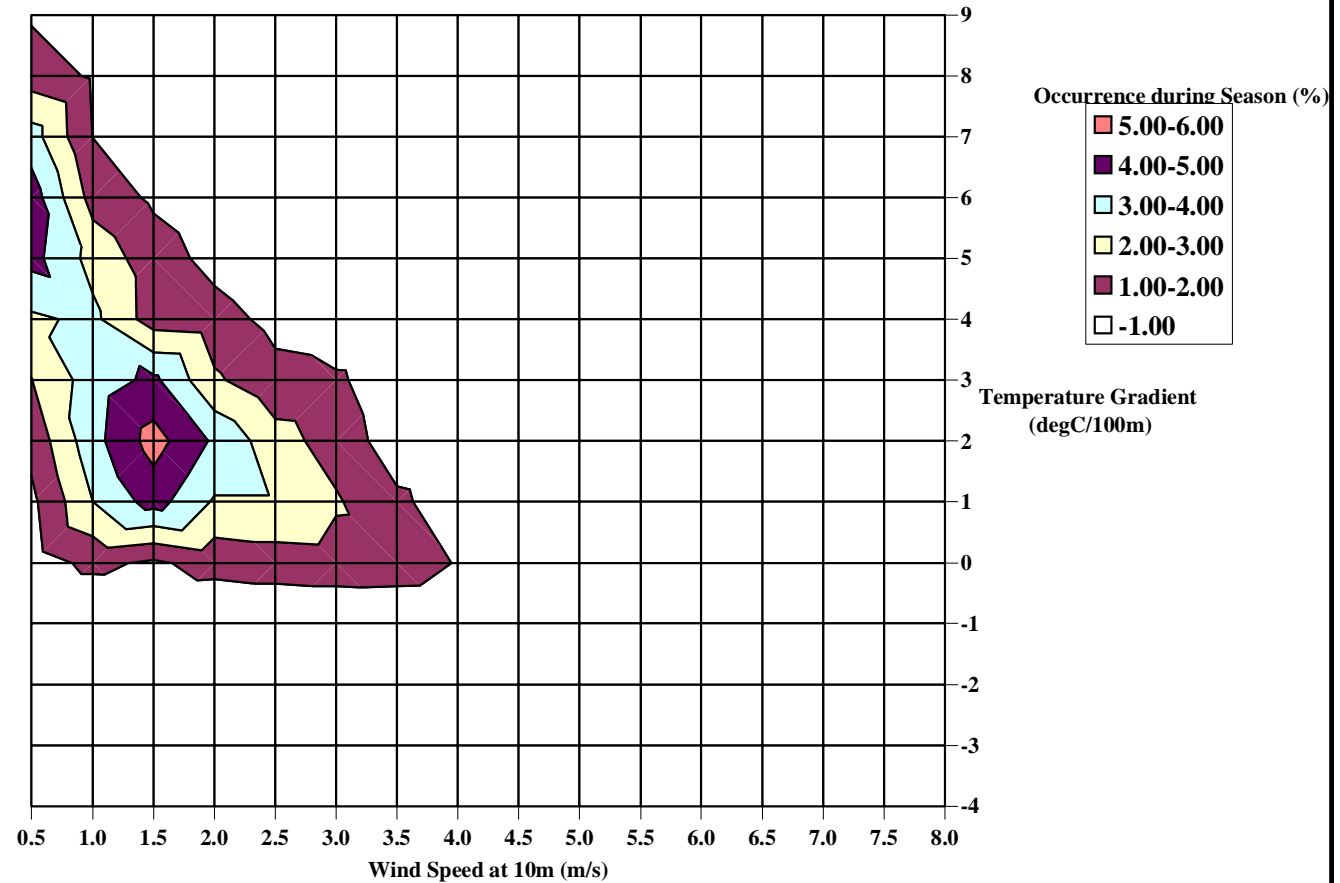
Percentage Occurrence of Wind Speeds and Temperature Gradients during Winter for Daytime Hours





# 1998 Guidance – Cullacabardee data – Winter/night

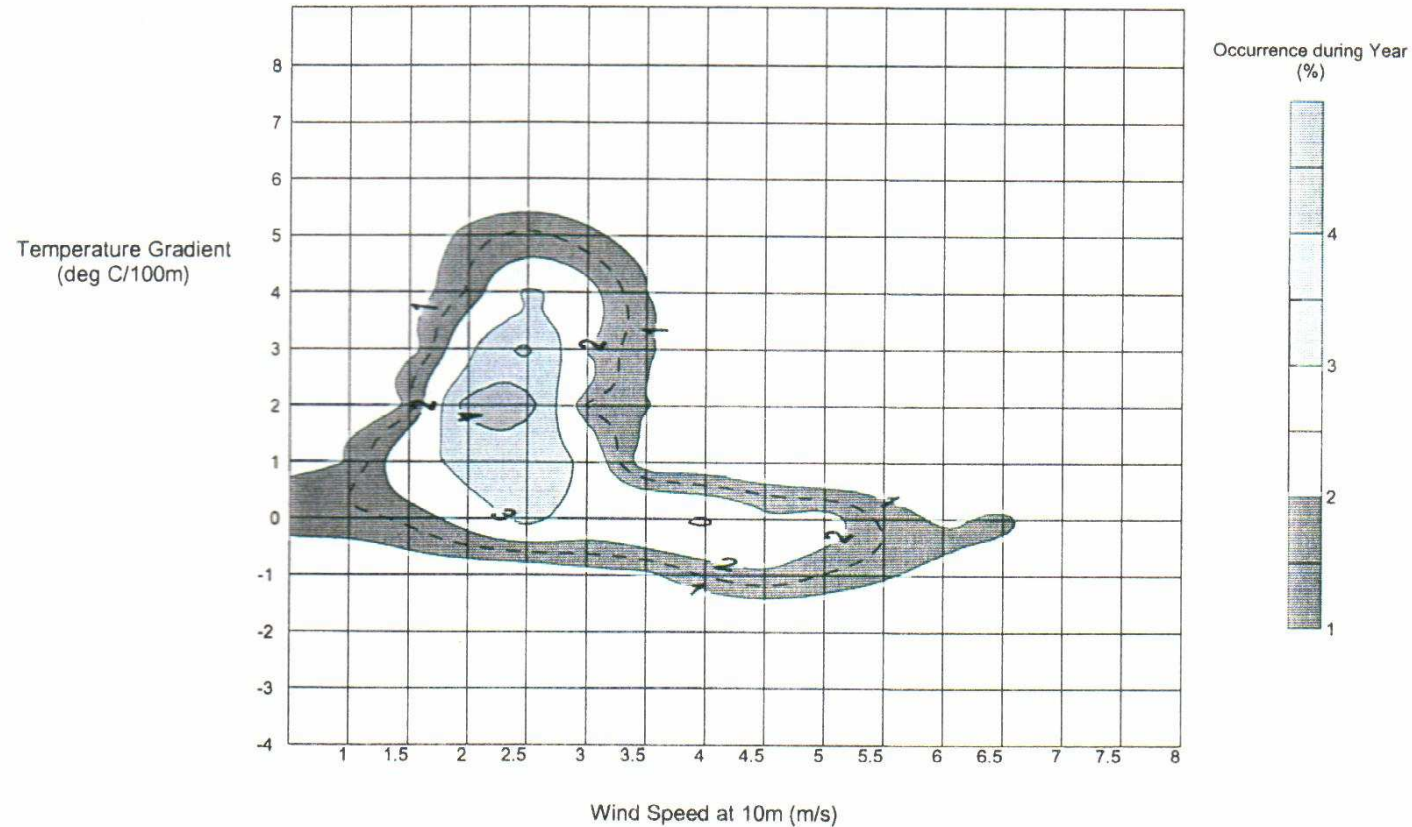
Percentage Occurrence of Wind Speeds and Temperature Gradients during Winter for Nighttime Hours





# 1998 Guidance – Cullacabardee data of Kwinana

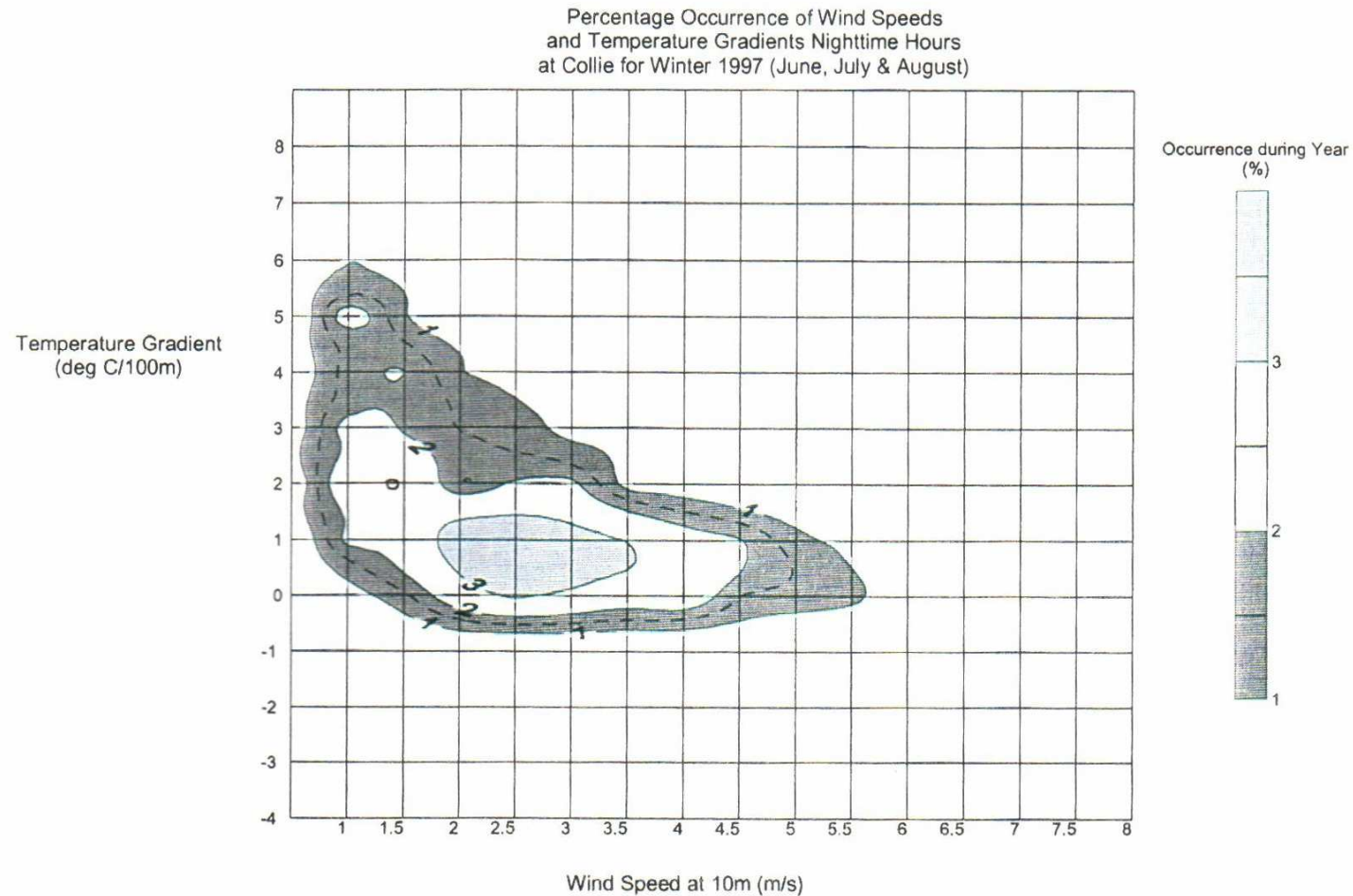
Percentage Occurrence of Wind Speeds and Temperature Gradients for Nighttime Hours at Kwinana for Winter



■ Figure C-6 Percentage Occurrence of Wind Speeds and Temperature Gradients for Night Time Hours at Kwinana During Winter



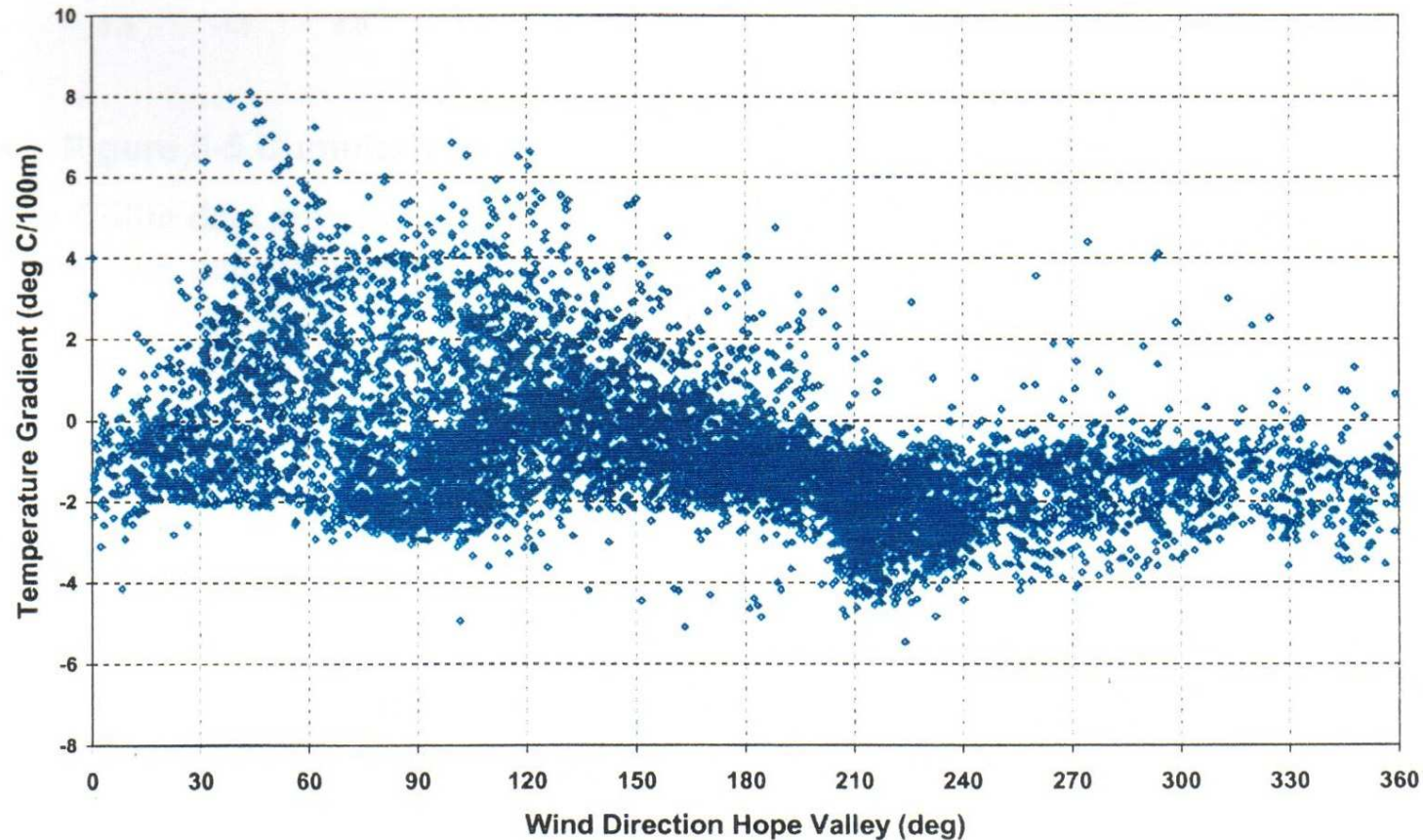
# 1998 Guidance – Cullacabardee data of Collie



■ Figure C-11 Percentage Occurrence of Wind Speeds and Temperature Gradients for Night Time Hours at Collie During Winter



## Does worst case apply in all wind directions?

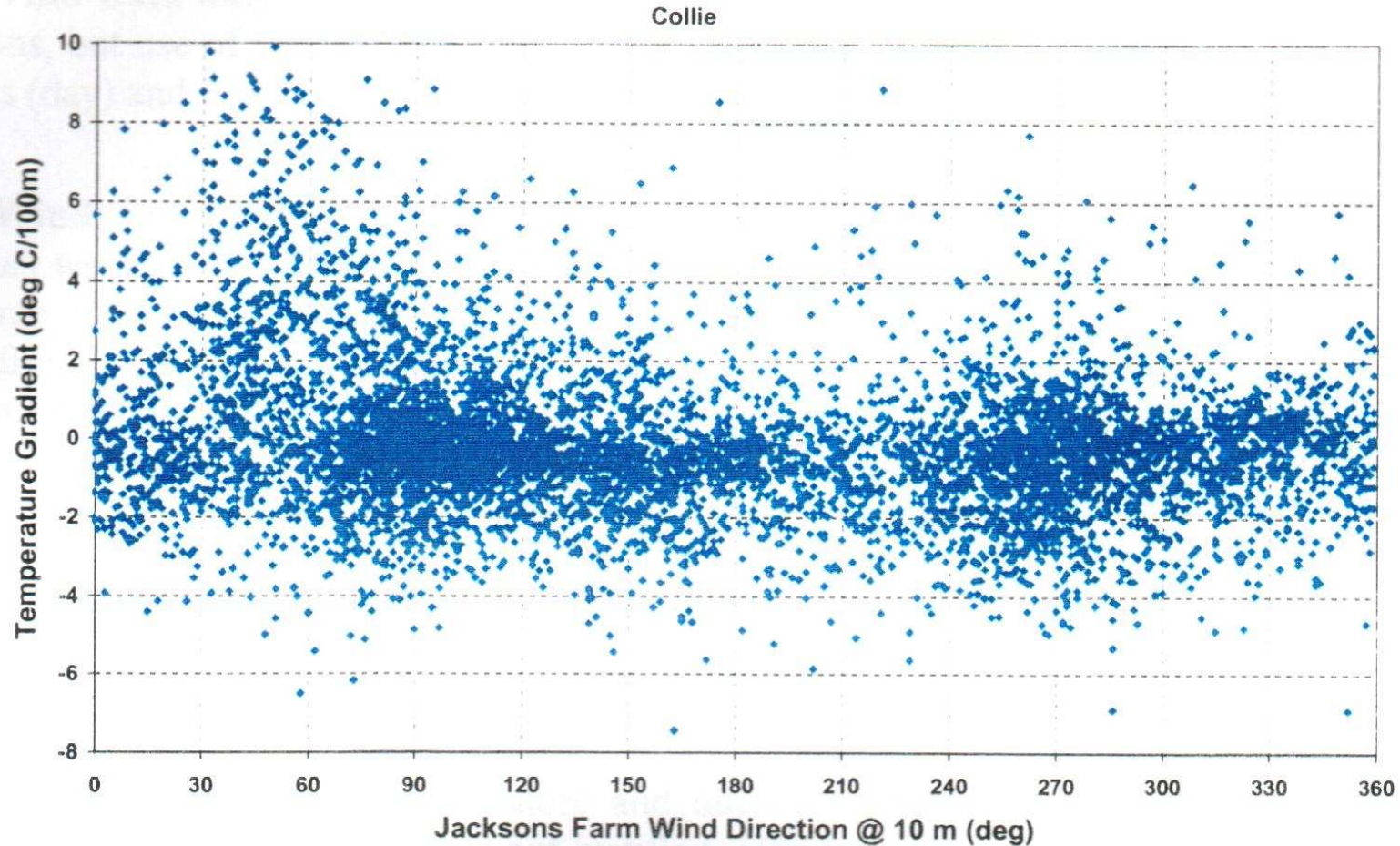


- Figure 5-4 Temperature Gradient (deg C/100m) versus Wind Direction at Kwinana





## Does worst case apply in all wind directions?



■ Figure 5-6 Temperature Gradient (deg C/100m) versus Wind Direction at Collie



## DOIR/SKM Review of 1998 Guidance – Is Cullacabardee data representative of WA?

- Kwinana and Collie – yes  
**Guidance 8 – retains 1998 default conditions**
- Arid areas – need to study: not done yet  
**Guidance 8 – use default conditions**
- Onshore winds near coast – no temp inversion  
**Guidance 8 – recognises site met. data**
- Inland (Collie) temp inversion all wind directions
- Study Culla data to confirm on coastal plain: not done  
**Guidance 8 – inland assume temp inversion**



## DOIR/SKM Review of 1998 Guidance – Is the site-specific procedure workable?

- Analysis of Kwinana and Collie data –

Site-specific procedure led to the *default values* for wind speed and temp inversion (3m/s, 2degC/100m), and therefore provided little value

- Monthly data too sparse – need seasonal data

- Wind direction angle not clearly defined

**Guidance 8 – removed formulae for site-specific meteorological data – use default values**

**Guidance 8 – recognises submissions based on site met. data or propagation measurements**





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## Guidance 8 – Two Models Go Head-to-Head!



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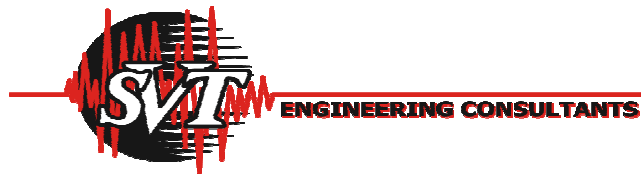


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# SVT Review of Guidance 8 Meteorological Factors

**Jim McLoughlin**

**SVT Engineering Consultants**





<b>Model</b>	<b>Advantages</b>	<b>Disadvantages</b>
SoundPlan	<ul style="list-style-type: none"><li>• Good presentation.</li><li>• Easy to use.</li><li>• Can show wind in all directions, so needs only one map.</li></ul>	<ul style="list-style-type: none"><li>• Generally less conservative than ENM.</li><li>• Cannot directly input some detailed weather conditions.</li></ul>
ENM	<ul style="list-style-type: none"><li>• Good for noise source ranking.</li><li>• Verified and accepted by State EPAs.</li><li>• Individual contour map for specific weather conditions.</li></ul>	<ul style="list-style-type: none"><li>• Results in lots of contour maps from various worst case wind directions.</li><li>• Difficult to use.</li></ul>





Item	ENM	SoundPlan
Temp. inversion effect	<ul style="list-style-type: none"><li>• Uses temp diff. &amp; wind</li><li>• Temp diff degC/100m</li><li>• Contin. variable, capped</li><li>• Data: Parkin &amp; Scholes</li><li>• Wind &amp; temp effects additive</li></ul>	<ul style="list-style-type: none"><li>• Uses Met.Category 1-6</li><li>• Based on Pasquill Stability</li><li>• Step change</li><li>• Data: CONCAWE</li><li>• Wind &amp; temp effects separate</li></ul>
Met. effects and other factors	<ul style="list-style-type: none"><li>• Met effects can negate barrier attenuation</li><li>• Influenced by ground surface roughness</li><li>• Influenced by large source height</li></ul>	<ul style="list-style-type: none"><li>• Met effects independent of presence of barrier</li><li>• No influence from ground surface roughness</li><li>• No influence from source height</li></ul>





## SVT Review – SoundPlan vs ENM – equivalent inputs

Guidance 8 Default Conditions	ENM Input Parameters		Equivalent SoundPLAN Parameters		
	Wind Speed (m/s)	Inversion Rate (deg C /100m)	Wind Speed (m/s)	Pasquill Stability Class	Met. Category
Day	4	0	4	E	6
Night	3	2	3	F	6





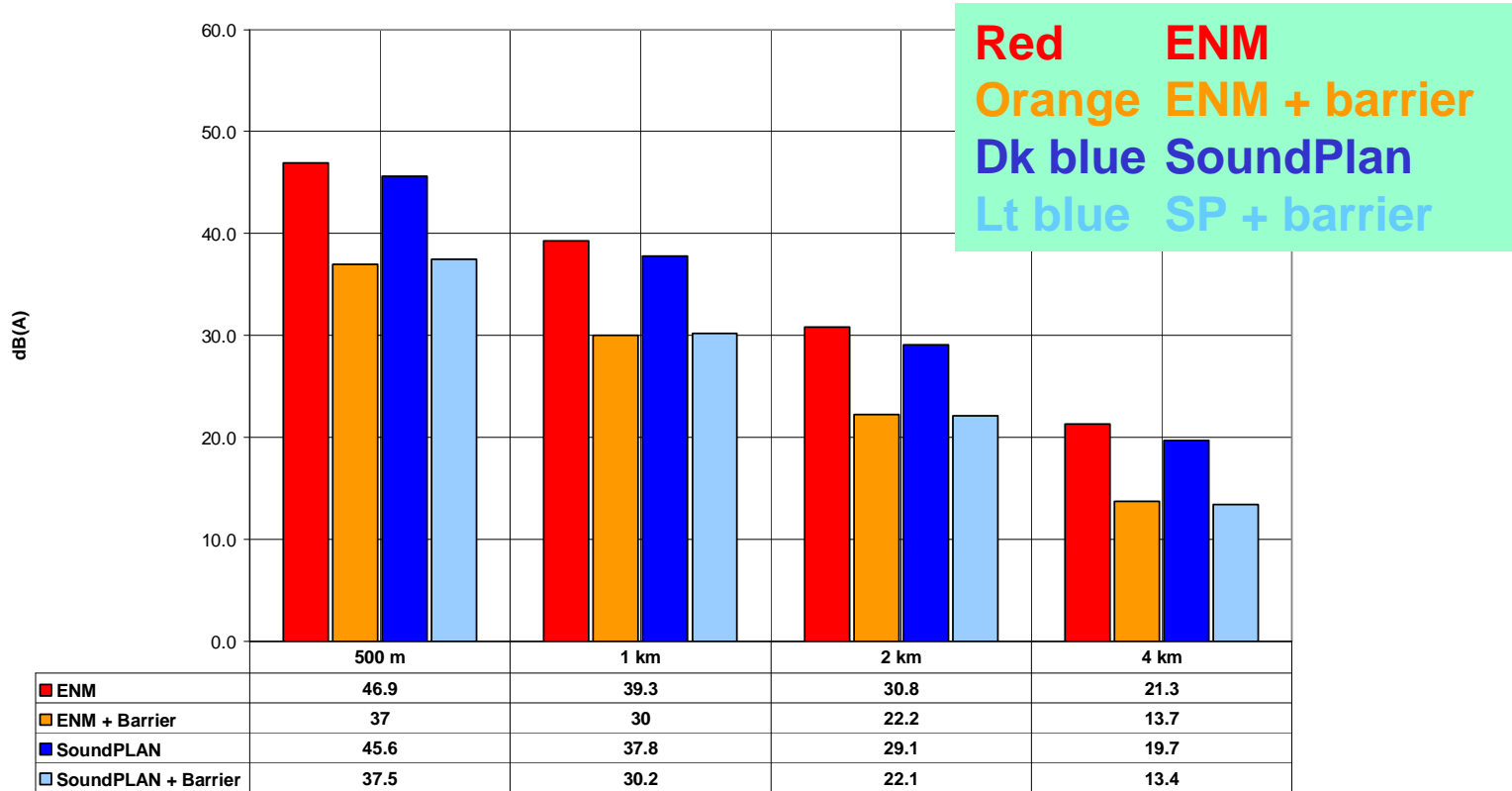


## SVT Review – SoundPlan vs ENM – outputs

- **Noise predictions –**
  - Calm and default meteorological conditions
  - Day and night
  - Distances: 500m, 1km, 2km, 4km; 1.5m above hard ground
- **Three source spectra at 110dB(A) sound power –**
  - High frequency dominates
  - Flat frequency spectrum
  - Low frequency dominates (typical industry)
- **With and without 3m noise barrier –**
  - Barrier 15m from source
  - Barrier length 100m



# SVT Review – SoundPlan vs ENM – outputs

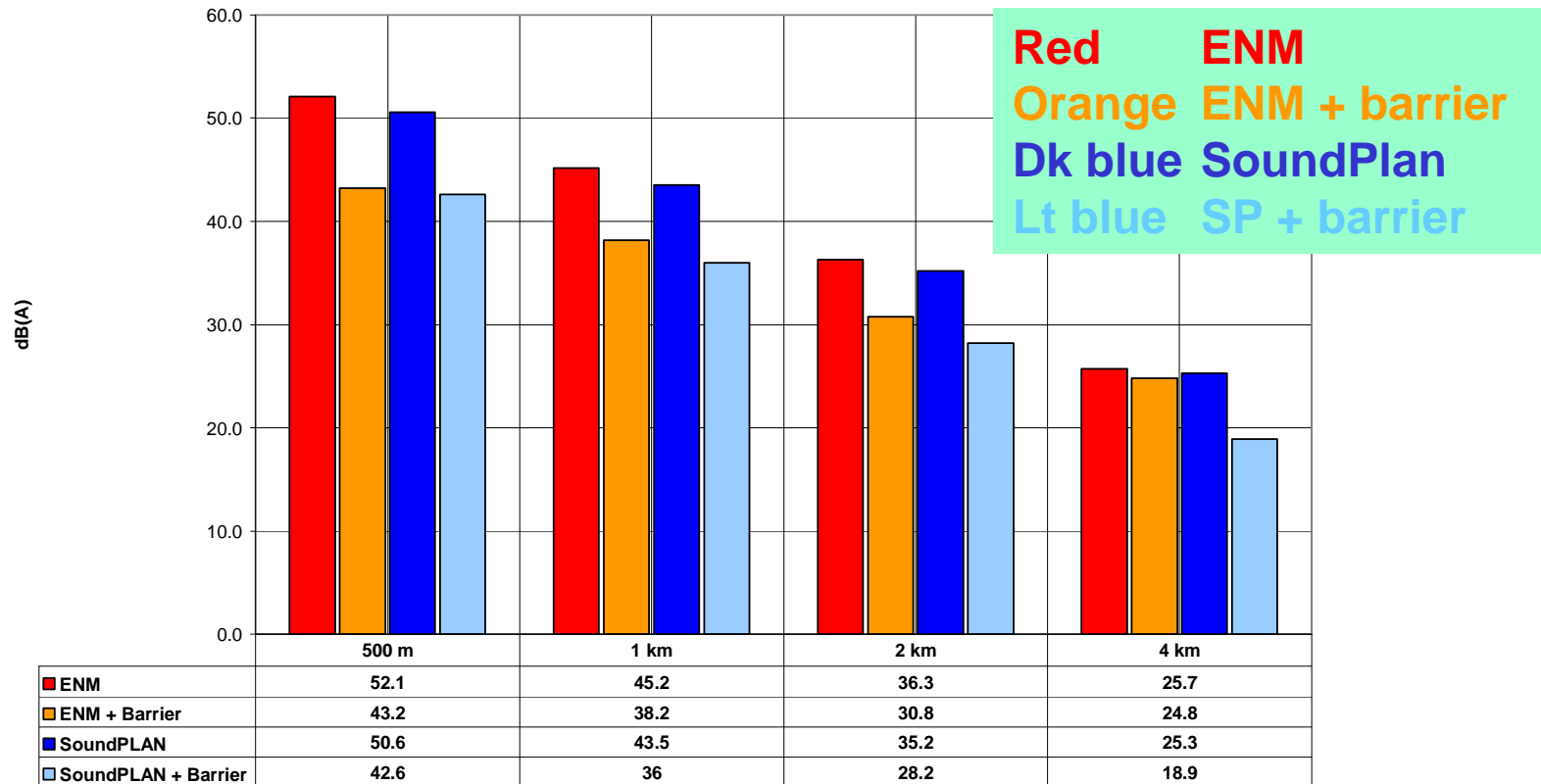


Comparison of Results for Calm Night-time Conditions – Low Frequency Spectrum





# SVT Review – SoundPlan vs ENM – outputs



## Comparison of Results for Worst-Case Night-time Conditions – Low Frequency Spectrum





## SVT – SoundPlan vs ENM – dB(A) comparisons

<b>Model (Low freq spectrum, night, at 2km)</b>	<b>ENM</b>	<b>SoundPlan</b>	<b>ENM with barrier</b>	<b>SoundPlan with barrier</b>
<b>Calm</b>	<b>0 (Ref)</b>	<b>-1.7</b>	<b>-8.6</b>	<b>-8.7</b>
<b>Worst case</b>	<b>+5.5</b>	<b>+4.4</b>	<b>0</b>	<b>-2.6</b>





## ENM vs SoundPlan – Conclusions from SVT Review

- Equivalent model input parameters can be set
- Similar predicted levels for calm
- Met effects independent of other effects in SoundPlan but not in ENM
- Barrier causes greatest difference in predicted level
- No simple conversion factor between models
- Met effects greatest at different frequencies
- ENM met effect constant after 616m, but keeps increasing with SoundPlan





## Guidance 8 – Implications of SVT Review

- Equivalent model input parameters –
  - **Guidance 8 adopts SVT proposal for SoundPlan**
- Both calm and worst case models should be done –
  - **Has not been adopted into Guidance 8 (so far)**
- Barriers must be clearly documented –
  - **Noted in Guidance 8, P18**
- Standard for calculating air absorption should be specified to be ANSI S1.26 in SoundPlan –
  - **Has not been adopted into Guidance 8 (so far)**





## Guidance 8 – Implications of SVT Review (cont)

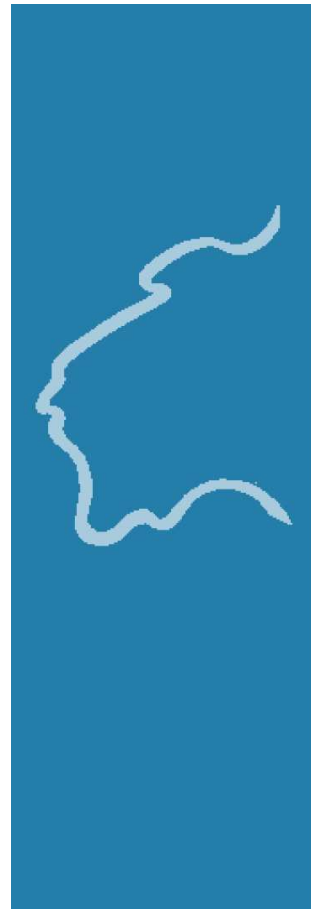
- Statement about 11dB(A) enhancement should be removed –
  - **Removed from Guidance 8**
- Other models in SoundPlan should be studied, eg. Nord 2000 and Gauss Beam, both of which allow wind and temperature gradient inputs –
  - **Has not been studied (so far)**





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## Guidance 8 – Other sections



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## Guidance 8 – Screening assessment (Section 4)

- Assists proponents and environmental consultants to decide if noise needs detailed assessment
- Retained from 1998 with some updates
- Considers –
  - Likely level of community concern
  - Buffer distances in Guidance 3
  - Estimated operational noise
  - Out-of-hours construction work
  - Blasting
- Appendix 1 worksheet





## Guidance 8 – Detailed assessment (Section 5)

- Details technical aspects of modelling
- Also, Guidance on -
  - Measurement of ambient noise
  - Other activities in proposal, eg. reversing beepers
  - Blasting and construction noise
- **Emphasis on good documentation –**
  - **Assigned noise level calculations (new)**
  - Inputs and results of noise modelling
  - Noise reduction measures
  - **Content of acoustic consultant's report (Appendix 2 new)**



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# Guidance 8 – Your comments? Open to 2 July!



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