Table of Contents

Executive Summary ..................................................................................................................5
1 Introduction ............................................................................................................................6
2 Site description .......................................................................................................................7
3 Ambient noise environment .................................................................................................10
3.1 Ambient noise monitoring procedure .............................................................................10
4 Environmental noise modelling .........................................................................................13
4.1 Model input data ..............................................................................................................13
4.2 Atmospheric conditions ...................................................................................................14
4.3 Model scenarios ................................................................................................................15
4.4 Modelling results and discussion ....................................................................................26
4.5 Predicted noise emission contours ................................................................................27
5 Conclusions and recommendations ..................................................................................33

List of Figures

List of Figures ..........................................................................................................................3
Table 2-1: Environmental noise measurement and model receiver positions. 7 ......................4
Table 4-1: Overall sound power levels and data source information. 13 .................................4
Table 4-2: 1/1-octave band sound power level spectra. 13 .......................................................4
Table 4-3: Predicted sound pressure levels. 25 ........................................................................4
Figure 2-1: Aerial view of the Kettering ferry terminal and surrounds with the extent of Figure 2-2 marked ..............................................................................................................8
Figure 2-2: Aerial view of the Kettering ferry terminal and surrounds with environmental noise monitoring and model receiver locations marked. ...............................................................8
Figure 2-3: General arrangement for Berth 2 (provided by Burbury Consulting) .......................9
Figure 2-4: Bruny Island ferry, existing timetable (provided by SeaLink) .................................9
Figure 3-1: Extended unobserved $L_{Aeq,15min}$, background and transient noise ($L_{A90}$ and $L_{A10}$) measured at position R1. ........................................................................................................11
Figure 3-2: Extended unobserved $L_{Aeq,15min}$ levels measured at position R1. ..................11
Figure 3-3: Extended unobserved $L_{A90,15min}$ levels measured at position R1. ...............12
Figure 4-1: Model plan view of the Mirambeena model scenario ........................................16
Figure 4-2: Model wire frame view of the Mirambeena model scenario viewed from the south...
                                                                                             ..................................................................................................................17
Figure 4-3: Model plan view of the Bowen model scenario ....................................................18
Figure 4-4: Model wire frame view of the Bowen model scenario viewed from the south ......19
Figure 4-5: Model plan view of the Nairana model scenario ..................................................20
Figure 4-6: Model wire frame view of the Nairana model scenario viewed from the south .....21
Figure 4-7: Model view of the Bowen, Berth 2 model scenario ............................................22
Figure 4-8: Model wire frame view of the Bowen, Berth 2 model scenario viewed from the south .........................................................................................................................23
Figure 4-9: Model plan view of the Nairana, Berth 2 model scenario .....................................24
Figure 4-10: Model wire frame view of the Nairana, Berth 2 model scenario viewed from the south .........................................................................................................................25
Figure 4-11: Predicted noise emission contours, Mirambeena ..............................................28
Figure 4-12: Predicted noise emission contours, Bowen .......................................................29
Figure 4-13: Predicted noise emission contours, Nairana .....................................................30
Figure 4-14: Predicted noise emission contours, Bowen, Berth 2 .......................................31
Figure 4-15: Predicted noise emission contours, Nairana, Berth 2 .......................................32

List of tables
Table 2-1: Environmental noise measurement and model receiver positions. ............................... 7
Table 4-1: Overall sound power levels and data source information.............................................. 14
Table 4-2: 1/1-octave band sound power level spectra. ................................................................. 14
Table 4-3: Predicted sound pressure levels. .................................................................................... 26

References
Executive Summary

Tarkarri Engineering was commissioned by Burbury Consulting on behalf of SeaLink to conduct an environmental noise assessment as part of a Development Application for a proposed upgrade to provide a second berth to the Kettering Bruny Island ferry terminal.

The monitoring of noise emission from existing operations at the Kettering Bruny Island ferry terminal and the modelling of potential future operations with a second berth in place demonstrate that terminal activity meets the planning scheme criteria. Noise emission impact would not increase significantly from an existing and long-standing situation.

To minimise potential noise emission impact Tarkarri Engineering has provided recommendations regarding engineering noise controls for the Bowen and restricted use of the Bowen ferry prior to control upgrades.
1 Introduction

Tarkarri Engineering was commissioned by Burbury Consulting (BC) on behalf of SeaLink to conduct an environmental noise assessment as part of a Development Application (DA) for a proposed upgrade to provide a second berth to the Kettering Bruny Island ferry terminal.

The under section 31.3.2 of the Kingborough Interim Planning Scheme 2015 a use standard is provided in relation to the potential impact of noise generated by Port and Marine operations on residential amenity. The relevant section is provided below:-

To address the above Tarkarri Engineering proposed the following approach:-

- Monitor ambient noise levels at a representative residential location for a minimum of 1-week.
- Develop source sound power spectra for the major noise emitting equipment and operations from measurement of existing sources on-site and SoundPLAN 8.2[1] data.
- Construct an environmental noise model of operations using SoundPLAN 8.2[1].
- Predict noise levels at residential locations and produce noise emission contour maps.
- Assess predicted noise levels against planning scheme criteria and existing ambient noise emission levels in the area.
- Where assessment of predicted noise levels identifies potentially excessive impact develop noise mitigation recommendations.
2 Site description

The Kettering Bruny Island ferry terminal is located on the northern side of Ferry Road on the southern side of Oyster Cove. The ferries operate daily from 0630 (0730 on Sundays) to 0700 (last departure form Kettering terminal).

Three vessels are utilised, the Mirambeena, Bowen and Nairana, the latter being the newest of the vessels. Another new vessel is planned, equivalent to the Nairana and when this is in operation the Mirambeena would be removed from the service. Currently the vessels operate on an hourly timetable during off-peak times and half-hourly during peak times. With the second new vessel in place and the additional berth the vessels would move to a 20-minute timetable.

The closest potentially noise sensitive residential premises are located on the southern side of Ferry Rd.

An environmental noise monitoring location (position R1), located approx. 25 m from the terminal land, was utilised for the measurement of ambient noise levels. Four additional environmental noise model receivers (positions R2 – R5) were also identified for the prediction of the environmental noise levels.

The location of each position is provided in Table 2-1 below while Figures 2-1 and 2-2 show the location of the monitoring and model receiver positions. Figure 2-3 provides a general arrangement of the proposed second berth upgrade. Figure 2-4 provides the existing off-peak and peak ferry timetables for the ferries while Figure 2-5 presents the proposed timetable with the second new vessel (equivalent to the Nairana) and 2nd berth are in place.

<table>
<thead>
<tr>
<th>Number</th>
<th>Location</th>
<th>Coordinates (MGA94, Zone 55 G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>76 Ferry Rd (monitoring location)</td>
<td>520844 5224975</td>
</tr>
<tr>
<td>R1</td>
<td>70 Ferry Rd</td>
<td>520796 5224978</td>
</tr>
<tr>
<td>R2</td>
<td>78 Ferry Rd</td>
<td>520876 5224962</td>
</tr>
<tr>
<td>R3</td>
<td>86 Ferry Rd</td>
<td>520924 5224904</td>
</tr>
<tr>
<td>R4</td>
<td>88 Ferry Rd</td>
<td>520960 5224880</td>
</tr>
</tbody>
</table>

Table 2-1: Environmental noise measurement and model receiver positions.
Figure 2-1: Aerial view of the Kettering ferry terminal and surrounds with the extent of Figure 2-2 marked.

Figure 2-2: Aerial view of the Kettering ferry terminal and surrounds with environmental noise monitoring and model receiver locations marked.
Figure 2-3: General arrangement for Berth 2 (provided by Burbury Consulting).

Figure 2-4: Bruny Island ferry, existing timetables (provided by SeaLink).
3 Ambient noise environment

3.1 Ambient noise monitoring procedure

All measurements were carried out in general accordance with the *Tasmanian Noise Measurements Procedures Manual*.

An unattended logging sound level meter (SLM) was located at 76 Ferry Rd and captured relevant 15-minute Ln-statistics for a period of approx. 7 days (17 – 23 July 2020).

**NB:** The off-peak timetable was in place during the monitoring period.

Figure 3-1 shows the $L_{Aeq,15min}$, $L_{A10,15min}$ and $L_{A90,15min}$ levels logged for the measurement period. Figures 3-2 and 3-3 provide logged $L_{Aeq,15min}$ and $L_{A90,15min}$ levels respectively across a single 24 hr period with each data series representing each day of logged data.
Figure 3-1: Extended unobserved $L_{A_{eq},15\text{min}}$, background and transient noise ($L_{A_{90}}$ and $L_{A_{10}}$) measured at position R1.

Figure 3-2: Extended unobserved $L_{A_{eq,15\text{min}}}$ levels measured at position R1.
From the above:-

- A clear signal of ferry terminal activity is evident in the measurement data between 0600 and 2000 hrs. Between these times periodic peaks in $L_{Aeq}$ and $L_{A90}$ levels are evident that coincide with ferry loading and unloading times.

- The highest peaks in $L_{Aeq}$ levels, typically in excess of 55 dBA occurred at times when ferry unloading activity was occurring and were generally 5 to 10 dBA higher than levels generated during loading activity. The higher noise levels generated during the unloading process is likely to be the result of vehicles accelerating along Ferry Rd heading west after the roundabout. Vehicles pass-bys would have been close to the sound level meter at such times (approx. 4 to 5 m) while vehicle movements during the loading process would have been at greater distance and lower speed.

**NB:** High vehicle pass-bys noise levels would have been generated outside of the ferry terminal land.

**NB:** High $L_{Aeq}$ levels present at approx. 0800 hrs on the weekend are likely to have been generated local to the meter and not from noise generated at the terminal.
4 Environmental noise modelling

SoundPLAN\textsuperscript{1} software was used for carrying out detailed noise emission spectra and contour modelling. This program allows the use of the CONCAWE\textsuperscript{2} calculation method for modelling atmospheric attenuation/amplification of noise. Parameters influencing sound propagation and attenuation include:

- Source type (point, line, plane).
- Relative source and receiver height.
- Topography and barriers.
- Industrial buildings as sources and/or barriers.
- Ground and air absorption.
- Distance attenuation.
- Atmospheric conditions (Pasquill stability, temperature, humidity and vector wind speed).
- Reflecting surfaces.
- Source directivity.

As all propagation and attenuation parameters are frequency dependent, all input source data has been based on 1/1 and 1/3-octave band sound power spectra.

Geo-referenced topographic, transport, building and hydrologic data was obtained from LISTdata. This provided contours at 5 and 10 m intervals; residential locations; road layouts; cadastral parcels; and river and stream courses for the area modelled.

Equipment list and layout data for operations were provided by BC.

All source and geodata is referenced to the Map Grid of Australia (MGA).

4.1 Model input data

Input sound power (SWL) spectra were calculated from Tarkarri Engineering measurements of ferry operations and SoundPLAN library data for standard low speed vehicle movements and engine start up. Table 4-1 presents overall SWLs and data details while table 3-7 presents 1/1-octave band SWL spectra.

NB: From observation of terminal activity the loading of vehicles onto the ferries at Kettering was deemed to be the most likely to generate high $L_{Aeq,15min}$ levels as a result of activities within the terminal land. Approaches of and departures form the terminal are short duration events and the noise levels generated are similar to loading activity, i.e. ferry engine generated noise while holding the ferry at the berth, with the addition of vehicle movement noise.
Overall sound power levels (dBA)

<table>
<thead>
<tr>
<th>Source</th>
<th>SWL</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L&lt;sub&gt;eq&lt;/sub&gt;</td>
<td>L&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
<tr>
<td>Mirambeena</td>
<td>100</td>
<td>Radiated noise breakout from the lower deck area and radiated noise from the sides and upper deck.</td>
</tr>
<tr>
<td>Traffic (Mirambeena)</td>
<td>85*</td>
<td>Loading of 40 vehicles from the 3 waiting lanes. L&lt;sub&gt;max&lt;/sub&gt; for a vehicle starting up.</td>
</tr>
<tr>
<td>Bowen</td>
<td>102</td>
<td>Engine exhaust noise and engine room vent breakout noise.</td>
</tr>
<tr>
<td>Traffic (Bowen)</td>
<td>81*</td>
<td>Loading of 18 vehicles from 2 of the waiting lanes. L&lt;sub&gt;max&lt;/sub&gt; for a vehicle starting up.</td>
</tr>
<tr>
<td>Nairana</td>
<td>95</td>
<td>Engine air intake breakout and radiated noise. Under hull engine exhaust noise.</td>
</tr>
<tr>
<td>Traffic (Nairana)</td>
<td>81*</td>
<td>Loading of 18 vehicles from 2 of the waiting lanes. L&lt;sub&gt;max&lt;/sub&gt; for a vehicle starting up.</td>
</tr>
</tbody>
</table>

*Scaled for time of each vehicle operation in a 15-minute period.

Table 4-1: Overall sound power levels and data source information.

1/1-octave band sound power levels spectra (dBA)

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency (Hz)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31.5</td>
<td>63</td>
</tr>
<tr>
<td>Mirambeena</td>
<td>75</td>
<td>83</td>
</tr>
<tr>
<td>Traffic (Mirambeena)</td>
<td>66</td>
<td>70</td>
</tr>
<tr>
<td>Bowen</td>
<td>58</td>
<td>86</td>
</tr>
<tr>
<td>Traffic (Bowen)</td>
<td>63</td>
<td>67</td>
</tr>
<tr>
<td>Nairana</td>
<td>71</td>
<td>75</td>
</tr>
<tr>
<td>Traffic Nairana</td>
<td>63</td>
<td>67</td>
</tr>
</tbody>
</table>

Table 4-2: 1/1-octave band sound power level spectra.

### 4.2 Atmospheric conditions

SoundPLAN<sup>[9]</sup>, via the CONCAWE<sup>[2]</sup> prediction algorithm, models atmospheric attenuation using Pasquill stability indices in combination with vector wind speed and direction to determine appropriate frequency dependent attenuation/amplification. In this study the following propagation condition was considered:

- **Neutral propagation**: Situations where the atmospheric conditions are considered to be neutral occur with a Pasquill stability class D and no wind.

**NB**: Due to the proximity of nearby residences worst-case weather conditions were not considered here. At such distances (i.e. < 100 m) meteorological effects on noise propagation are negligible.
4.3 Model scenarios

The following operational scenarios were modelled:-

**Berth 1 (existing)**
- **Mirambeena**: Mirambeena at the berth while loading 40 vehicles.
- **Bowen**: Bowen at the berth while loading 18 vehicles.
- **Nairana**: Nairana at the berth while loading 18 vehicles.

**Berth 2**
- **Bowen**: Bowen at the berth while loading 18 vehicles.
- **Nairana**: Nairana at the berth while loading 18 vehicles.

**NB**: The Mirambeena wouldn't be operated at Berth 2.

Figures 4-1 to 4-10 present model plan and wire-frame views of the each of the five modelling scenarios.
Figure 4-1: Model plan view of the Mirambeena model scenario.
Figure 4-2: Model wire frame view of the Mirambeena model scenario viewed from the south.
Figure 4-3: Model plan view of the Bowen model scenario.
Figure 4-4: Model wire frame view of the Bowen model scenario viewed from the south.
Figure 4-5: Model plan view of the Nairana model scenario.
Figure 4-6: Model wire frame view of the Nairana model scenario viewed from the south.
Figure 4-7: Model plan view of the **Bowen, Berth 2** model scenario.
Figure 4-8: Model wire frame view of the Bowen, Berth 2 model scenario viewed from the south.
Figure 4-9: Model plan view of the Nairana, Berth 2 model scenario.
Figure 4-10: Model wire frame view of the **Nairana, Berth 2** model scenario viewed from the south.
4.4 Modelling results and discussion

Table 4-3 presents predicted sound pressure levels ($L_{Aeq,15min}$) at the five receiver locations from the five modelling scenarios.

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Berth 1</th>
<th>Berth 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mirambeena</td>
<td>Bowen</td>
</tr>
<tr>
<td>R1</td>
<td>50</td>
<td>52</td>
</tr>
<tr>
<td>R2</td>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td>R3</td>
<td>52</td>
<td>53</td>
</tr>
<tr>
<td>R4</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>R5</td>
<td>47</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 4-3: Predicted sound pressure levels.

**NB:** Noise levels were logged at a validation point adjacent to the terminal building and these showed good correction (within 1 dB) with the predicted noise levels from each vessel at the same location (i.e. from operations at Berth 1). Given this the model is considered good predictor of noise emission levels from terminal operations.

From the table above:-

- Predicted sound pressure levels vary between 41 and 55 dBA. The highest noise levels are generated by the Bowen ferry and the lowest by the Nairana.

- Operations of the Bowen and Nairana at Berth 2 results in predicted levels 1 to 3 dB higher than operations and Berth 1. At receiver R1 the predicted level is lower with the Nairana at Berth 2 due to the increased topographic shielding provided.

- It is assumed in this report that concurrent loading/unloading of vessels at the terminal wouldn't occur with Berth 2 in place. However, should this occur then predicted noise levels with the Mirambeena or Bowen at Berth 1 and Nairana at Berth 2 would be less than or equal to 54 dBA at the receiver locations. With the two new vessels at the berths the levels would be less than or equal to 50 dBA.

- Maximum noise levels generated by vehicle start up in the waiting lanes generated levels less than 60 dBA at all receivers (predicted levels are not presented here).

**NB:** Maximum noise levels generated by the Bowen during start up have the potential to exceed 65 dBA at nearby residences, particularly when the 2 engines are started with the engine room doors open. This includes start up at either Berth 1 or 2 or at its overnight mooring to the west of the terminal.

- Predicted 1/3-octave band spectra (not presented here) indicate that intrusive noise characteristics such as tonality and excessive low frequency noise are not generated by the Mirambeena and Nairana. The Bowen, however, while not generating excessive low frequency does produce a spectrum that is potentially tonal at 80 Hz.
4.5 Predicted noise emission contours

Using the environmental noise model, noise contour maps were generated to assist in the visualisation of noise propagation from the site to the surrounding environment. The contours shown consider the following:-

**Berth 1 (existing)**

- Mirambeena
- Bowen
- Nairana

**Berth 2**

- Bowen
- Nairana

The 55 dBA contour is highlighted in turquoise in all the contour maps.
Figure 4-11: Predicted noise emission contours, **Mirambeena**.
Figure 4-12: Predicted noise emission contours, Bowen.
Figure 4-13: Predicted noise emission contours, Nairana.
Figure 4-14: Predicted noise emission contours, **Bowen, Berth 2**.
Figure 4-15: Predicted noise emission contours, Nairana, Berth 2.
5 Conclusions and recommendations.

The monitoring of noise emission from existing operations at the Kettering Bruny Island ferry terminal and the modelling of potential future operations with a second berth in place demonstrate that terminal activity wouldn’t significantly raise noise levels in the area. With the second berth and second new vessel the frequency of operations at the terminal would increase, however, noise levels would be lower than currently occur as a result of operation of the Mirambeena and Bowen (even with two new vessels at the berths concurrently). It should be noted that the highest noise levels in the area are the result of vehicles accelerating along Ferry Road after leaving the terminal land upon disembarkation and this would continue to be the case. Given the above, impact would not increase significantly from an existing and long-standing situation, satisfying the performance criteria from the planning scheme, i.e. environmental harm wouldn't occur in the residential zone.

While under the new timetable with two berths at the Kettering terminal the typical operation would be the two new vessels operating, at times the Bowen may be used when demand is high. To minimise potential noise emission impact Tarkarri Engineering provides the following recommendations with regard to the Bowen:-

- Upgrade the silencing of the engine exhausts on the Bowen to provide an additional 10 dB insertion loss at the 80 Hz 1/3-octave band and a minimum of 5 dB in each 1/3-octave band across the range 250 Hz to 2.5 kHz.
  
  **NB:** The above insertion loss recommendations are in addition to existing silencer performance.

- Start-up of the Bowen should be conducted with the engine room door closed to minimise noise breakout.

Prior to engine exhaust silencer upgrades on the Bowen the following should be followed:-

- Operations of the Bowen should not occur prior to 0700 hrs and preferably not prior to 0900 hrs.

- As far as practically possible the Bowen should not be operated at Berth 2 following the upgrade.

- Should concurrent loading and unloading of ferries at the Berth 1 and 2 be considered in the future then this should be restricted to the two new vessels. The Bowen should not be concurrently operated at the terminal with other ferries.