Rescycle Pty Ltd
Avoca End of Life Tyre Recycling Facility
AMBIENT NOISE STUDY

Project MPCS 2014-04b
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Thanks also to Bill Wilson from the Tasmanian EPA staff, for providing advice in relation to the noise propagation technique to be used.
Executive Summary

Rescycle Pty Ltd (Rescycle) propose to establish an ‘end of life tyres’ processing facility on a 10.6 ha site at Avoca in northern Tasmania, using an existing pyrolysis plant which has operated successfully in Western Australia on a similar waste stream.

At maximum production rate, the plant is capable of processing two tonne per hour of waste tyres. Tyres will arrive onsite in whole or chipped form, with approximately one delivery per hour at full production rate.

Conservative sound powers were assigned to the pyrolysis plant; the tyre shredding plant; a wheeled loader; and for delivery trucks. A simple noise propagation model was developed which logarithmically added sound powers together to provide a total sound power which emits continuous noise from the centre of the site. Noise levels were predicted at sixteen sensitive receptor locations, and on a dense polar grid extending out to 2100 m from the site centre.

Scenarios were developed for:

- Daytime operations (7:00 am to 6:00 pm), when all sources are in operation
- Evening (6:00 to 10:00 pm) and night-time (10:00 pm to 7:00 am), when only the pyrolysis plant is in operation
- Out of hour deliveries during a morning shoulder period (5:00 am to 7:00 am) and the evening period, when noise from the pyrolysis plant is augmented by delivery truck noise.

Daytime and evening noise levels comfortably met the noise amenity criteria for suburban residences, from the NSW Industrial Noise Policy. The night-time criterion was also met at all sensitive receptors but one. There are a number of mitigating factors, not accounted for in the modelling program, which suggest that the night-time criterion would be met at the closest sensitive receptor location. Despite this, Rescycle have committed to building a three metre high masonry noise barrier adjacent to the pyrolysis and tyre shredding plants. This will reduce sound power from these plants in the direction of the town of Avoca and the closest sensitive receptors by 10 to 15 dB(A), thereby dealing with this nominal ‘non-compliance’.

Tyre delivery trucks have been conservatively characterised, and represent the most significant noise source, particularly given that the noise model assumes that continuous truck noise will occur during delivery hours. These overly conservative assumptions have resulted in high predicted noise levels during out of hours delivery events. In reality truck noise will add little to the current noise environment, as at peak production the Rescycle plant will only add one truck delivery per hour, in the context of 1145 vehicles, and 156 heavy vehicles, passing the proposed Rescycle site per day. Delivery trucks will only be onsite for short durations during delivery events, not the full hour, and can be managed if necessary by requiring engines to be switched off when the vehicle is parked or is being manually unloaded. Out of hours deliveries are therefore not expected to represent a significant noise nuisance.

The plant will initially operate at half its maximum production rate, providing a good opportunity for attended and unattended noise measurements to be made at the closest sensitive receptor sites, and for noise reduction measures to be refined.
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1 Introduction
This report supports the proposal by Rescycle Pty Ltd ('Rescycle') to establish an ‘end of life tyres’ (ELT) processing facility at Avoca, at the mouth of the Fingal Valley in northern Tasmania. Rescycle aim to relocate an existing pyrolysis plant, which has operated successfully in Western Australia on a similar waste stream, to their Avoca site.

The Rescycle ELT processing facility utilises a Thermal Desorption Pyrolysis Plant (TDPP) designed by ToxFree Systems Inc. It is designed to process ELT’s at a maximum rate of two tonnes/hour. The TDPP separates ELT’s into char; steel; fuel concentrate; and gas. The gas stream will be destroyed within a thermal oxidiser and chemical scrubber, however all other components will be marketed and sold.

When in operation the plant will run 24 hours a day, however deliveries of shredded and whole tyres will be limited to between 5 am and 10 pm six days a week, with most deliveries occurring in daytime hours. The TDPP will initially be operated at around one tonne of waste per hour, with plant throughput gradually increasing to the maximum production rate of two tonnes per hour.

2 Site Boundary
The Rescycle ELT recycling facility footprint will be 0.7 ha in extent, and will occupy part of a 10.6 ha site previously housing a saw mill. The plant footprint extends over two titles (243096/1 and 250729/2), however the broad site encloses an additional land parcel (45/874) currently fenced into three paddocks. Figure 1 shows the proposed plant footprint in relation to the broad site and individual land titles.

Figure 1  The Rescycle ELT Recycling Facility boundaries (red line) in relation to the internal site boundaries (white) and the plant footprint (green).
3 Plant Layout

The proposed plant layout is shown in Figure 2. The TDPP occupies a site at the southeast boundary of the plant footprint. The tyre shredding plant is adjacent to this. The northeast side of the pyrolysis and tyre shredding plants are flanked by a 3 m high masonry noise barrier, with a 1 meter return on each end. This is sited to reduce noise levels from these plants at sensitive receptor locations in this direction. There are two waste tyre stockpiles, sited at the centre and northwest of the site.

![Site layout for the Rescycle ELT Recycling Facility.](image)

**Figure 2** Site layout for the Rescycle ELT Recycling Facility. The red rectangle represents the pyrolysis plant, with the stack shown as a black dot. The purple rectangle represents the tyre shredding plant. The two waste tyre stockpiles are shown as grey rectangles. The three metre high masonry noise wall is shown in grey on the northeast side of the pyrolysis and shredding plants. The decommissioned sawmill building is shown as a cyan rectangle.

4 Sensitive Receptors

The sixteen closest sensitive receptor locations surrounding the Rescycle ELT Recycling Facility site are identified in Table 1, and are mapped in Figure 3. The closest sensitive receptor (Receptors 2) is located in Grant Street approximately 241 m to the north of the proposed stack location. Another relatively close receptor on the western side of the Esk Highway, is located approximately 415 m to the west of the stack in Franks Street. The southern extent of the town of Avoca lies approximately
400 m northeast of the stack (Receptors 3 to 7). Receptor 8 is located in Royal George Road, nearly 800 m to the east of the stack.

Receptors 9 to 16 are all located significantly further away from the site, on a private access road. They are established in an arc spreading from the E to the SSE of the stack. These receptors could only be identified using Google imagery, as the private road is gated and public access is not allowed. It is highly likely that only two or three of the identified receptors are actual residences, with the remainder being outbuildings, sheds or other farming structures.

Receptors 1 to 7 are all within 430 m of the TDPP exhaust stack, and have been identified as the closest receptor locations to the Rescycle ELT Recycling Facility.

Table 1  Sensitive receptor locations surrounding the Rescycle ELT Recycling Facility site. The terrain height at the stack location is 204 m.

<table>
<thead>
<tr>
<th>Point #</th>
<th>Easting, GDA94</th>
<th>Northing, GDA94</th>
<th>Location</th>
<th>Distance from Stack, m</th>
<th>Terrain Height, m</th>
<th>Bearing</th>
<th>Critical Wind Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>559261</td>
<td>5373667</td>
<td>Franks St</td>
<td>414</td>
<td>206</td>
<td>W</td>
<td>E</td>
</tr>
<tr>
<td>2</td>
<td>559653</td>
<td>5373939</td>
<td>Grant St</td>
<td>241</td>
<td>201</td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>559769</td>
<td>5374117</td>
<td>Intersection Esk Hwy &amp; Storys Creek Rd</td>
<td>429</td>
<td>200</td>
<td>NNE</td>
<td>SSW</td>
</tr>
<tr>
<td>4</td>
<td>559854</td>
<td>5374023</td>
<td>St Pauls Place</td>
<td>371</td>
<td>201</td>
<td>NNE</td>
<td>SSW</td>
</tr>
<tr>
<td>5</td>
<td>559911</td>
<td>5374005</td>
<td>St Pauls Place</td>
<td>387</td>
<td>203</td>
<td>NE</td>
<td>SW</td>
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<tr>
<td>6</td>
<td>559937</td>
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<td>St Pauls Place</td>
<td>391</td>
<td>204</td>
<td>NE</td>
<td>SW</td>
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<td>7</td>
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<td>St Pauls Place</td>
<td>406</td>
<td>201</td>
<td>NE</td>
<td>SW</td>
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<tr>
<td>8</td>
<td>560459</td>
<td>5373827</td>
<td>Royal George Rd</td>
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<td>200</td>
<td>E</td>
<td>W</td>
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<td>9</td>
<td>560783</td>
<td>5373140</td>
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<td>1242</td>
<td>203</td>
<td>ESE</td>
<td>WNW</td>
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<tr>
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<td>WNW</td>
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<td>11</td>
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<td>5372832</td>
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<td>200</td>
<td>SE</td>
<td>NW</td>
</tr>
<tr>
<td>12</td>
<td>560962</td>
<td>5372798</td>
<td>Private access road</td>
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<td>200</td>
<td>SE</td>
<td>NW</td>
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<tr>
<td>13</td>
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<td>5372766</td>
<td>Private access road</td>
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<td>200</td>
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<td>14</td>
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<td>SE</td>
<td>NW</td>
</tr>
<tr>
<td>15</td>
<td>560171</td>
<td>5372294</td>
<td>Private access road</td>
<td>1490</td>
<td>200</td>
<td>SSE</td>
<td>NNW</td>
</tr>
<tr>
<td>16</td>
<td>560062</td>
<td>5372333</td>
<td>Private access road</td>
<td>1420</td>
<td>212</td>
<td>SSE</td>
<td>NNW</td>
</tr>
</tbody>
</table>
Figure 3 Sensitive receptor locations in relation to the Rescycle ELT Recycling Facility stack (yellow dot), the plant footprint (cyan), and site boundaries (red with white sub-boundaries).

5 Pyrolysis Process

Figure 4 summarises the ToxFree tyre recycling process. Tyres are delivered onsite in either whole or chipped form. Whole ELT’s are de-beaded (the wire rims removed) and shredded onsite. Shredded tyres are fed into the indirectly fired, vertical rotating retort, which thermally volatilises them at a temperature of 550 °C under oxygen depleted conditions. The 30 minute retention time for solids within the retort produces char, steel fragments, and a hydrocarbon-rich gas stream.

The char and steel are separated, using a magnetic separator, for subsequent sale. The gas stream is further filtered within the patented high temperature filter (HTF). This removes fine particles down to minus 0.01 microns at retort temperatures, providing a clean gas stream into the two-stage condenser. The HTF therefore eliminates the need for gas cooling prior to particle removal within a bag house. It therefore reduces both operating and capital costs.

The two stage condensing process cools the process gas down to 30 °C in the first stage and then to 7 °C in the second, separating it into a liquid distillate which is collected for recycling, and a residual hydrocarbon-rich gas stream.
The residual gas has a high calorific value, and is suitable for collection and recycling, however in the first instance Rescycle do not plan collect this resource and instead will destroy it within a thermal oxidiser (“the afterburner”). The afterburner will operate at a temperature of 1200 °C, at a minimum of three per cent oxygen, with a retention time of 1.5 seconds.

Acidic gases from the afterburner are predominantly sulphuric in nature. These will be rapidly quenched to inhibit the formation of dioxins and furans, and further treated within a caustic soda scrubber system specifically designed to remove approximately 95% of the SO₂ and HCl remaining (JW Technologies, 2008, p9).

The retort is initially fired on LPG, however once the process is established it will be sustained using a proportion of the residual gases, with the remainder being destroyed within the afterburner.

In the future it would be desirable to replace the afterburner with a compression loop in order to condense and collect the process gas for ultimate use in power generation. This would maximise the profitability of the process, however it is not envisaged in this current proposal.

A small proof of concept plant commissioned by ToxFree in Surry, British Colombia (EarthTech, 2007, p. iii), operating at an ELT feed rate of 50 kg/h, produced an average of 347.5 g char; 342.5 g fuel condensate; and 310 g gas per kilogram ELT processed.

The char was found to have a heat value close to that of coal, thereby making it suitable as a fuel source in the cement or pulp paper industries. Alternatively it could be used as carbon black within the tyre industry or as activated carbon. The fuel condensate was hydrocarbon rich, and was similar
to a synthetic crude. It could therefore be used to power diesel generators for electricity generation or sold to an oil refinery as a feedstock. The residual gas stream was found to be rich in methane, propane and butane, making it a valuable fuel source suitable for power generation within gas-fired generators or combined cycle turbines.

In the initial stages it is planned to operate the plant at a reduced rate, likely to be around one tonne per hour. Whilst noise emissions from the retort will similar regardless of the plant throughput, ancillary noise from the other sources, such as whole tyre shredding; tyre deliveries; and loader operations will be less, due to reduced operating hours. This will give Recycle a good opportunity to understand their noise emissions better and to manage them as throughput increases.

6 Noise Amenity Criteria

In the absence of specific Tasmanian noise amenity criteria, amenity criteria from the NSW Industrial Noise Policy (EPA, 2000) were adopted.

The Rescycle site is located in a rural locality, and is adjacent to Esk Main Road. Esk Main Road is classified as a ‘Category 3 — Regional Access Road’ under the Tasmanian State Road Hierarchy. These are ‘arterial roads, which comprise the main inter-regional routes connecting rural towns to regional centres’ (DIER, 2011, p. 3).

Esk Main Road currently carries approximately 1145 vehicles per day near the proposed Rescycle site, with 13.5% of these (156 vehicles per day) being heavy vehicles. The speed limit adjacent to the Rescycle site is 50 km/h. It is estimated that by 2014 there will be 140 vehicles per hour (70 vehicles per hour in each direction) passing the Rescycle site during the morning and evening peak hours. Traffic noise is therefore a significant existing and future component of the noise environment. (Knightley, 2014)

On this basis it is not reasonable to classify the Rescycle noise environment as being ‘Rural’, as the NSW Industrial Noise Policy defines a rural environment as being “… an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic” (EPA, 2000, p. 17).

The most reasonable classification therefore appears to be ‘Suburban’. The NSW Industrial Noise Policy defines this as:

an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:

- Decreasing noise levels in the evening period (1800 to 2200); and/or
- Evening ambient noise levels defined by the natural environment and infrequent human activity.

This area may be located in either a rural, rural-residential or residential zone … (EPA, 2000, p. 18)

The NSW Industrial Noise Policy notes that these time periods may be varied where appropriate (p. 18). In addition, Section 3.3 provides guidance for dealing with ‘shoulder periods’, where for example early morning operations are proposed. This is exactly the situation with the Rescycle plant, as normal deliveries are planned to occur during day-time hours between 7:00 am and 6:00 pm, six days a week. On occasion however it may be necessary to accept deliveries occurring during the night-time hours between 5:00 am and 7:00 am, or up to 10:00 pm in the evening.
It is therefore proposed, in line with the policy, that a morning ‘shoulder’ period be adopted between 5:00 am and 7:00 am to allow for early morning deliveries. The criterion would be the mean of the day and night criteria. Given that the evening period lasts for four hours, and evening deliveries could extend throughout this time, it is not feasible to propose that an evening shoulder period be adopted.

Table 2 shows the criteria applying to residences in suburban areas, and includes the proposed morning shoulder period.

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Recommended Acceptable $L_{Aeq}$ Noise Level, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day (7:00 am to 6:00 pm)</td>
<td>55</td>
</tr>
<tr>
<td>Evening (6:00 pm to 10:00 pm)</td>
<td>45</td>
</tr>
<tr>
<td>Night (10:00 pm to 7:00 am)</td>
<td>40</td>
</tr>
<tr>
<td>Proposed Morning Shoulder Period(\dagger) (5:00 am to 7:00 am)</td>
<td>48</td>
</tr>
</tbody>
</table>

Source: EPA, 2000, Table 2.1, p. 16.
\(\dagger\) Taken as the mean of the day and night criteria in accordance with S 3.3 of EPA 2000.

7 Estimated Noise Emissions

When the Rescycle TDPP was in operation within the Kwinana Industrial Precinct, the site permit contained general conditions relating to waste disposal; a daily visual inspection of all operational systems and the premises; and the establishment and maintenance of a spill log book. There were specific conditions provided for water pollution control; air pollution control; air monitoring requirements; waste disposal, and reporting. There were however no noise conditions imposed on the site. This indicates that the WA Department of Environment and Protection considered noise emissions to be a second order issue.

The following four major noise sources have been identified:

- The pyrolysis plant
- The tyre shredding plant
- Noise from trucks delivering whole or shredded ELT’s, and removing product from the site
- The loader used to load whole ELT’s into the shredding plant and shredded ELT’s into the pyrolysis plant.

It is likely that staff vehicles will attend the site, however noise emissions from this source are considered to be too short term and sporadic to be accounted for in this analysis.

Whilst there will be other noise sources onsite, these are all assumed to be minor in nature and as such will not contribute significantly to the noise emissions from the site.

7.1 Pyrolysis Plant

Despite extensive enquiries, Rescycle have been unable to locate any noise testing reports from the period when the plant was in operation in Kwinana. The only significant information available was that the original plant had a sound pressure level (SPL) of 70 dB(A) when measured from a distance of 10 m. The plant was subsequently quietened further, however measured results are not available (Falconer, pers. comm., 26/10/2014).
The measured SPL of 70 dB(A) at a distance of 10 m from the pyrolysis plant was therefore adopted as a conservative estimate of the noise emissions to be emitted when it is relocated to the Avoca site. Given this, it is possible to estimate the plant’s sound power using Equation 1,

$$L_w = L_p + 10 \log \left( \frac{Q}{4 \pi d^2} \right)$$  

where $L_w$ is the sound power dB(A), $L_p$ is the measured SPL, dB(A), $Q$ is the sound directivity (set to 2 for hemispherical spreading), and $d$ is the distance in m, from the measurement point to the source. This yields a sound power of 98 dB(A), which was applied continuously throughout all periods of the day.

7.2 Shredding Plant

Anecdotal evidence also suggests that whilst sited in Kwinana, the tyre shredding plant was inaudible above background at distances beyond about 30 m (Falconer, pers. comm., 26/10/2014). This piece of information is too vague to be of any real use in determining an appropriate sound power to assign to the tyre shredding plant. Instead a sound power was assigned on the basis of values found in a literature review.

Mellor (2012) estimated noise propagation from an Evashred EV60E tyre shredder, designed to shred passenger tyres at a rate of 3 t/h. The manufacturers stated that when operating unloaded, the shredder emits a noise level of 76 dB(A) when measured at a distance of 1 m. Mellor conservatively estimated that when shredding tires, the SPL at a distance of 1 m would rise to 88 dB(A). Using Equation 1, this equates to an estimated sound power of 96 dB(A).

The shredding plant was assumed to be in operation only during the daytime period.

7.3 Unloading Operations

End of life tyres, will arrive onsite in either chipped or whole form, from historic stockpiles, retail outlets and industrial operations around the state, including mines on the west coast. Despite their source, deliveries will be maintained to ensure that stockpiles do not get too large. There will therefore be a steady stream of deliveries, at a rate of approximately one delivery per hour during the working day, with occasional deliveries out of working hours. The trucks making deliveries will therefore vary in size and sound powers according to their source.

It was assumed that trucks unloading whole or shredded ELTs will either be manually unloaded or will tip their load directly onto stockpiles. The loader will therefore not be used as part of unloading operations.

Standards Australia (2010) provides a typical A-weighted sound power for trucks greater than 20 tonne of 107 dB(A). Given the large variety of trucks expected to attend the site, this is expected to be a conservative value.

It is assumed that there will be one truck unloading event each hour during daylight hours. Trucks are expected to be onsite for a maximum of 15-20 minutes during each loading event. Some trucks will remain idling during this time however many will turn their engine off. Despite this, the unloading sound power of 107 dB(A) was conservatively assumed to extend throughout the entire hour.
7.4 Loader
The loader is used to stack delivered tyres prior to their shredding, to load tyres into hoppers for the whole tyre shredder to process, and to load shredded tyres into the retort hopper. It is unlikely to be in continuous all-day operation, however it is envisaged that it may be in continuous use for periods of up to one or two hours at a time. The loader will only be in operation during daytime hours.

Standards Australia (2010) provides a typical A-weighted sound power for a wheeled loader of 105 dB(A), which was adopted to characterise the Rescycle loader.

7.5 Summary
Table 3 summarises the sound powers adopted to characterise each of the major noise sources.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sound Power, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrolysis Plant</td>
<td>98</td>
</tr>
<tr>
<td>Tyre Shredder Plant:</td>
<td>96</td>
</tr>
<tr>
<td>Truck (&gt; 20 T)</td>
<td>107</td>
</tr>
<tr>
<td>Loader</td>
<td>105</td>
</tr>
</tbody>
</table>

7.6 Scenarios
Three different scenarios were considered:

- Daytime Operations (7 am to 6 pm)
- Evening (6 pm to 10 pm) and Night-time Operations (10 pm to 7 am) and
- Out of Hours Unloading.

During the daytime hours, it is conservatively assumed that all four major noise sources will be in continuous operation. In reality, the tyre shredding plant; the loader; and unloading operations will be intermittent in nature, with only the pyrolysis plant operating continuously.

During the evening and night-time hours the pyrolysis plant will normally be the only major noise source in operation. On occasion however it may be necessary to receive deliveries between 5 am and 7 am in the morning or during the evening hours. The ‘Out of Hours Loading’ scenario accounts for the combined effect of the pyrolysis plant and a delivery truck.

The total sound power for each scenario was determined by logarithmically adding the sound powers for each active source. Equation 2 provides the addition formula used to calculate total sound power, where \( L_{w1} \) to \( L_{wn} \) represent the \( n \) sound powers to be summed.

\[
L_{w1} + L_{w2} + \cdots + L_{wn} = 10 \log \left\{ 10^{(L_{w1}/10)} + 10^{(L_{w2}/10)} + \cdots + 10^{(L_{wn}/10)} \right\} \tag{2}
\]

Table 4 summarises the sound powers used to characterise each of the three scenarios.

<table>
<thead>
<tr>
<th>Source</th>
<th>Day (7 am to 6 pm)</th>
<th>Evening (6 pm to 10 pm) &amp; Night (10 pm to 7 am)</th>
<th>Out of Hours Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrolysis Plant</td>
<td>98.0</td>
<td>98.0</td>
<td>98.0</td>
</tr>
<tr>
<td>Tyre Shredder Plant:</td>
<td>96.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck (&gt; 20 T)</td>
<td>107.0</td>
<td></td>
<td>107.0</td>
</tr>
<tr>
<td>Loader</td>
<td>105.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>109.6</td>
<td>98.0</td>
<td>107.5</td>
</tr>
</tbody>
</table>
8 Noise Propagation Estimation Approach

A simple approach was adopted to estimating propagation of noise from the site. For any given scenario, the sound powers from individual sources active during the time were logarithmically added to produce a total sound power for the site, using Equation 2 presented earlier.

The total sound power was assigned to a point location at the centre of the site. In this case the location of the exhaust stack was selected to characterise noise emissions from the site.

Equation 3 was used to estimate SPLs at known distances from the central source location,

\[ L_p = L_w - 10 \log \left( \frac{Q}{4 \pi d^2} \right) \]

where \( L_p \) is the A-weighted SPL at distance \( d \) from the source, \( L_w \) the A-weighted sound power of the source, \( Q \) the sound directivity (set to 2 for hemispherical spreading), and \( d \) is the distance from the source.

This formula provides a conservative estimate of sound propagation, as it does not account for atmospheric absorption, ground effects, reflection from surfaces, or screening by obstacles. Despite that it is appropriate for use in simple noise propagation studies such as this.

The SPL was directly estimated for each of the 16 closest sensitive receptor locations surrounding the plant. In addition sound pressure level predictions were made at 20 m intervals on a dense polar grid, extending from the source location out to a distance of 2100 m, at one degree radial intervals. The eastings, northings, and predicted sound pressure levels at each polar grid point were gridded onto a Cartesian grid using the Surfer contouring package. The resultant grids were plotted over an image of the region, with noise isopleths provided at 5 dB(A) intervals.

9 Noise Predictions

9.1 Daytime Operations (7 am to 6 pm)

The predicted daytime SPLs arising from the continuous operation of all four noise sources are presented in Figure 5. The predicted SPL at the closest sensitive receptor (Receptor 2) is 54 dB(A), which is below the ‘Acceptable’ daytime \( L_{Aeq} \) criterion of 55 dB(A).
9.2 Evening (6 pm to 10 pm) and Night-time (10 pm to 6 am) Operations

During the evening period, the pyrolysis plant is usually the only noise source in operation. Figure 6 shows the predicted noise levels arising from operation of the pyrolysis plant alone. The predicted SPL at Sensitive Receptor 2 is 42 dB(A) which is comfortably below the ‘Acceptable’ evening $L_{Aeq}$ criterion for suburban residences of 45 dB(A).

The pattern of noise dispersion from the pyrolysis plant during the night-time is the same as that predicted during the evening, however the amenity criterion is more stringent. Figure 7, showing the night-time noise predictions, is therefore identical to Figure 6 however the ‘Acceptable’ $L_{Aeq}$ criterion is 40 dB(A). This is comfortably met at all sensitive receptors except Receptor 2, which has a predicted SPL of 42 dB(A). The Receptor 2 prediction easily meets the ‘Recommended Maximum’ night-time $L_{Aeq}$ criterion for suburban residences of 45 dB(A).
Figure 6  Evening (6 pm to 10 pm) noise predictions, dB(A), from operations at the proposed Rescycle Thermal Desorption Pyrolysis Plant, Avoca. The acceptable evening $L_{Aeq}$ criterion, 45 dB(A), and recommended maximum daytime criterion, 50 dB(A), are shown as pink and red isopleths respectively. The cyan plus signs show the location of the closest sensitive receptor locations.

Figure 7  Night-time (10 pm to 6 am) noise predictions, dB(A), from operations at the proposed Rescycle Thermal Desorption Pyrolysis Plant, Avoca. The acceptable night-time $L_{Aeq}$ criterion, 40 dB(A), and recommended maximum daytime criterion, 45 dB(A), are shown as pink and red isopleths respectively. The cyan plus signs show the location of the closest sensitive receptor locations.
9.3 Out of Hours Deliveries

The noise predictions for tyre deliveries during the morning shoulder period (5 am to 7 am), and the evening period (6 pm to 10 pm), are shown in Figure 8 and Figure 9 respectively.

During the morning shoulder the predicted SPL at Receptor 2 is 52 dB(A). This exceeds the proposed acceptable shoulder criterion of 48 dB(A), but meets the proposed maximum shoulder criterion of 53 dB(A). The predicted SPL at Receptors 4; 5; and 6 are all equal to the acceptable shoulder criterion. Noise levels at all other identified sensitive receptor locations meet the proposed acceptable shoulder criterion.

![Figure 8](image)  
Noise predictions for tyre deliveries occurring during the ‘morning shoulder’ period (5 am to 7 am). The proposed acceptable $L_{Aeq}$ criterion, 48 dB(A), and maximum criterion, 53 dB(A), are shown as pink and red isopleths respectively. The cyan plus signs show the location of the closest sensitive receptor locations.

During the evening period, the predicted SPL at Receptor 2, 52 dB(A), exceeds the recommended maximum evening criterion of 50 dB(A). Receptor 1 and Receptors 3 to 7 all breach the acceptable evening criterion of 48 dB(A), but meet the maximum evening criterion. Noise levels at all other identified sensitive receptor locations meet the acceptable evening criterion.
9.4 Predicted Noise Levels at Sensitive Receptor Locations

A summary of predicted SPLs at each sensitive receptor location is provided in Table 5, which also provides the distance from the plant exhaust stack to each location.

<table>
<thead>
<tr>
<th>Receptor Number</th>
<th>Distance from Exhaust Stack (m)</th>
<th>Daytime Period (7 am to 6 pm) dB(A)</th>
<th>Evening Period (6 pm to 10 pm) dB(A)</th>
<th>Night-time Period (10 pm to 7 am) dB(A)</th>
<th>Out of Hours Deliveries dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amenity Criterion</td>
<td>Acceptable</td>
<td>55</td>
<td>45</td>
<td>40</td>
<td>47.2</td>
</tr>
<tr>
<td>1</td>
<td>414</td>
<td>49.3</td>
<td>37.7</td>
<td>37.7</td>
<td>47.2</td>
</tr>
<tr>
<td>2</td>
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<td>42.4</td>
<td>51.9</td>
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<tr>
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<td>37.4</td>
<td>37.4</td>
<td>46.9</td>
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<tr>
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<td>371</td>
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<td>38.6</td>
<td>48.1</td>
</tr>
<tr>
<td>5</td>
<td>387</td>
<td>49.9</td>
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<td>47.8</td>
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<tr>
<td>6</td>
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<td>38.2</td>
<td>47.7</td>
</tr>
<tr>
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<td>37.8</td>
<td>47.3</td>
</tr>
<tr>
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<td>795</td>
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<tr>
<td>10</td>
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<tr>
<td>11</td>
<td>1538</td>
<td>37.9</td>
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<td>26.3</td>
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<tr>
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<td>35.6</td>
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<tr>
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<tr>
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<td>1420</td>
<td>38.6</td>
<td>27.0</td>
<td>27.0</td>
<td>36.5</td>
</tr>
</tbody>
</table>
10 Construction Noise

Site preparation will commence once all necessary permits are obtained. The site footprint first needs to be cleared of logs and timber waste prior to concrete foundations and a hard stand area being established. It is expected that this work will take two months to complete in total. The pyrolysis and tyre shredding plants will then be transported and assembled onsite, and electrical connections and a water connection for a fire hydrant will be made. This phase will last for approximately one month. Commissioning activities will also take approximately a month to complete, before the plant is able to start its normal operations at a reduced one tonne per hour rate.

It will therefore take approximately four months to prepare the site; construct the plants; install the electrical and water infrastructure; and commission the plants. During this time care will be taken to ensure noise nuisance will not occur in the surrounding neighbourhood. Good working practices will be adopted including:

- Site preparation, construction and commissioning activities will be limited to standard working hours (7 am to 6 pm).
- Occupants of neighbouring properties will be notified in advance of any excessively noisy activities being undertaken. They will be told when and how long these tasks are expected to last for, and will be kept informed on progress.
- A principal contact person will be appointed to handle community queries about noise. All noise complaints will be effectively recorded, investigated and addressed.
- All vehicles and plant used onsite will be fitted with effective exhaust silencers.
- Machines in intermittent use will be shut down when not in use, or where this is impracticable will be throttled down to a minimum.
- Where practicable, excessively noisy activities will be scheduled for less sensitive times, and periods of respite will be provided.
- Where practicable, plant with directional noise characteristics will be orientated to minimise noise at nearby properties.
- The site compound and any static machines will be sited as far as is practicable from noise sensitive buildings.
- Care will be taken when handling materials to not drop them from excessive heights.

11 Discussion

At first glance the results presented above in Section 9 are worrying, as they suggest that the plant will not meet the night-time amenity criteria, and out of hours deliveries will breach both the evening and morning shoulder criteria. Such a view ignores the many mitigating factors that serve to make this assessment highly conservative.

Where possible conservative sound powers and modelling practices have been adopted. This means that each modelling scenario is likely to significantly over-predict actual SPLs. In particular:

- The sound propagation formula used (Equation 3) is conservative as it does not account for the mitigating effects of atmospheric absorption, ground effects, reflection from surfaces, or screening by obstacles.
- The sound powers used to characterise the main noise sources have been conservatively selected. The TDPP is known to have been quietened down in the time following its noise measurements; the tyre shredding plant has been conservatively characterised; and sound
powers associated with large 20 tonne trucks have been selected, making this a conservative value.

- The pyrolysis plant and shredder (when operating) are the only continuous noise sources, with the loader and trucks only being in short term operation during any given hour. Given that the loader and trucks are the dominant noise sources onsite, this assumption of continuous use is therefore seen as being overly conservative.

- The 3 m high masonry wall to the northeast of the pyrolysis and tyre shredding plants has not been taken into account when predicting SPLs at sensitive receptor locations. If there are no gaps in this wall, and there is a return at each end, then the wall should reduce noise emissions from these plants by 10 to 15 dB(A) in the shielded directions. This includes the town of Avoca, the closest sensitive receptor, and Sensitive Receptors 3 to 7.

- The closest sensitive receptor, Receptor 2, is slightly shielded by the terrain as it is at a terrain elevation 3 m lower than that of the plant. The roof of the residence at Receptor 2 is roughly level with Esk Main Road, and the bed rooms do not have direct line of site to the Rescycle site. Receptor 2 is also situated between Esk Main Road and St Pauls River. Traffic noise, and noise from the river will therefore serve to increase background noise levels and mask noise from the more distant Rescycle site.

- Noise levels onsite will certainly be lower than those occurring when the site hosted a sawmill.

The dominant noise source modelled is from tyre delivery trucks. At full production the plant will only add a single truck movement an hour to the noise environment. This is in the context of Esk Main Road currently carrying approximately 1145 vehicles per day past the proposed Rescycle site, with 13.5 % of these (156 vehicles per day) being heavy vehicles. Whilst on site, truck noise can be managed by requiring truck engines to be either switched off, or by minimising delivery time. Delivery trucks will therefore not pose a significant change to the existing ambient noise environment.

The initial planned operation of the plant at a one tonne per hour rate provides the opportunity for the operators to refine their noise mitigation practices, and if necessary to install further noise abatement measures, before the maximum operating rate of two tonne per hour is achieved. This could be conducted on the basis of the results of attended and unattended ambient noise measurements at Receptor 2.

12 Conclusions
This assessment has conservatively estimated ambient noise levels in the surrounding community arising from the proposed Rescycle ELT Recycling Plant.

Daytime and evening noise levels comfortably meet the noise amenity criteria for suburban residences from the NSW Industrial Noise Policy. This would be the case for the night-time period, however noise levels are predicted to exceed the acceptable criterion, but not the maximum criterion, at the closest sensitive receptor location.

This receptor does not have direct line of site to the plant, as it is at a lower elevation than the plant site. It is also situated between Esk Main Road and St Pauls River, both of which serve to increase ambient background noise levels. It is therefore considered that night-time noise levels from the proposed Rescycle plant would most likely meet the acceptable noise criterion.

Despite that, Rescycle has committed to erecting a three metre high masonry noise barrier next to the pyrolysis and tyre shredding plants. It is expected that this will reduce the sound power in the
direction of the town of Avoca, and Receptors 2 to 7, by 10 to 15 dB(A). This will therefore significantly reduce night-time noise levels from the pyrolysis plant in these directions, thereby dealing with this nominal ‘non-compliance’.

Whole and chipped tyres will be delivered onsite by delivery trucks. The conservative nature of this assessment means that tyre delivery trucks represent the most significant noise source, particularly given that the noise model assumes continuous truck noise will occur. These overly conservative assumptions have resulted in high predicted noise levels during out of hours delivery events in the early morning (5 am to 7 am) or during the evening period (6 pm to 10 pm). In reality truck noise will add little to the current noise environment, as at peak production the Rescycle plant will only add one truck delivery per hour, in the context of 1145 vehicles, and 156 heavy vehicles, passing the proposed Rescycle site per day. Delivery trucks will only be onsite for short durations during delivery events, not the full hour, and can be managed if necessary by requiring engines to be switched off when the vehicle is parked or is being manually unloaded. Out of hours deliveries are therefore not expected to represent a significant noise nuisance.

The plant will initially operate at half its maximum production rate, providing a good opportunity for attended and unattended noise measurements to be made at the closest sensitive receptor sites, and for noise reduction measures to be refined.

13 References


Falconer, K., pers. comm., 26/10/2014. Email to Steve Carter; Barry Williams; David Wessely; Ron Vairy; and Michael Power, 26/10/2014 10:47 am, Subject “Re: Rescycle plant for Tasmania”.


