Notice of Intent

Livingstone
DSO Hematite Mine Project
# Table of Contents

1. Introduction .................................................................................................................. 3  
2. Notice of Intent .............................................................................................................. 3  
   2.1 Contact details ....................................................................................................... 3  
   2.2 Project name and location ..................................................................................... 3  
   2.3 Proponent’s background ....................................................................................... 5  
   2.4 Project description ................................................................................................. 5  
   2.5 Stakeholder Consultation ....................................................................................... 8  
   2.6 Physical environment ............................................................................................. 9  
   2.7 Key issues .............................................................................................................. 24  
   2.8 Survey and studies .................................................................................................. 25  
   2.9 Proposed timetable ................................................................................................. 25  

# List of Figures

- Figure 1 - Local setting of the mining lease application area ........................................ 4  
- Figure 2 - Plan view of Livingstone Pit design ............................................................ 7  
- Figure 3 - Livingstone rock storage facility location .................................................... 9  
- Figure 4 - Proposed layout for the Livingstone mine project ........................................ 5  
- Figure 5 - Groundwater sampling locations ................................................................. 6  
- Figure 6 - Streams, catchment area, and surface water sampling locations ................. 12  
- Figure 7 - Distribution of vegetation communities ...................................................... 16  

# List of Tables

- Table 1 - Project summary .............................................................................................. 6  
- Table 2 - Areas of disturbance ..................................................................................... 5  
- Table 3 - Summary of groundwater monitoring bore characteristics ........................ 7  
- Table 4 - Monthly rainfall and temperature .................................................................. 10  
- Table 5 - Extent and reservation status of vegetation communities ............................... 15  
- Table 6 - Historic heritage inventory list ...................................................................... 22
1. **Introduction**

Venture Minerals Limited is proposing to develop a direct shipping ore ("DSO") hematite mine near Mt Livingstone in north western Tasmania. The Livingstone deposit is situated within granted exploration licence (EL21/2005) held 100% by Venture Minerals.

2. **Notice of Intent**

This Notice of Intent (NOI) has been developed in accordance with the Tasmanian Environment Protection Authority NOI guidelines and the requirements of Section 27B of the *Environmental Management and Pollution Control Act 1994*.

The project was referred to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* in April 2012. The referral provided the findings of specialist studies of the site which, in Venture Minerals’ opinion, demonstrated that the proposed mine would cause no significant impacts on Matters of National Environmental Significance.

Nevertheless, the Commonwealth Minister determined in July 2012 that the proposed project is a controlled action.

2.1 **Contact details**

Andrew Radonjic  
Technical Director  
Venture Minerals  
PO Box 186  
West Perth WA 6872  
Tel 08 9381 4222  
Fax 08 9381 4211  
E-mail andrew@ventureminerals.com.au

2.2 **Project name and location**

The project is known as the Venture Minerals Livingstone DSO Hematite Mine Project.

The project is located approximately 30 km west of the township of Tullah (approximately 42 km by road), in north western Tasmania. The site is located approximately 125 km southwest of Burnie.

Figure 1 shows the local setting of the mine project. Road access from the Tullah township is via the Murchison Highway and then the Pieman Road.

Venture Minerals is also progressing two other projects in the region, being the adjacent Mt Lindsay mine and the nearby Riley mine projects. NOI’s have been submitted for the Mt Lindsay project and the Riley project. Both these projects have been determined to be controlled actions. The three projects are standalone and not dependent on each other.
Figure 1 - Local setting of the mining lease application area
2.3 **Proponent’s background**

Venture Minerals was incorporated in Western Australia on 12 May 2006 and listed on the ASX in September 2006.

The Livingstone project and the adjacent Mt Lindsay tin-tungsten-magnetite project (for which a NOI has previously been submitted) have been the primary focus for Venture Minerals over the last 4 years, having spent over $25 million to date. Livingstone is one of two DSO hematite bodies that have been identified by the company (the other being at Riley which was recently discovered and for which a separate NOI has been submitted).

2.4 **Project description**

2.4.1 **General description**

Venture Minerals propose to extract DSO in the form of hematite, through a conventional open pit mine at the Livingstone mine site. The ore body lies in the Livingstone catchment, which is a sub-catchment of the Stanley River. As described later in this document, the Stanley River catchment has been subject to many historical mining activities (47 old sites have been identified, see Table 6 on page 22).

The hematite deposit is hosted within a north north-west striking skarn which has been metasomatised by Meredith Granite enriching the skarn with iron mineralisation that has been oxidised from magnetite to hematite.

The ore body is contained within the Livingstone Skarn and will be accessed through a single open pit designed using the Whittle optimisation program and Mine 2-4D software and based on a preliminary geotechnical study, which shows generally good ground conditions.

Conventional open pit mining equipment will be used including 80-100 tonne trucks and 15-25 cubic metre capacity excavators. The site will operate continuously (i.e. 24 hours per day, 7 days per week). A rock storage facility (RSF) will be established adjacent to the open pit.

Preliminary mine schedules have been completed to define waste removal requirements to achieve the required ore production from the open pit.

The mined ore will be crushed and screened on site and then trucked to a rail siding near the Bastyan Dam (just off the Pieman Road) for rail transport to the Port of Burnie. Table 1 summarises the proposed project.
Table 1 - Project summary

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life of project</td>
<td>2 years</td>
</tr>
<tr>
<td>Resource</td>
<td>DSO (Hematite)</td>
</tr>
<tr>
<td>Mining method</td>
<td>Open cut mining</td>
</tr>
<tr>
<td>Mine operation</td>
<td>Continuous day and night shifts</td>
</tr>
<tr>
<td>Average depth of pit</td>
<td>Single open pit 150 m deep</td>
</tr>
<tr>
<td>Depth to water table</td>
<td>Variable (from 0 to 50 m across the project site)</td>
</tr>
<tr>
<td>Total area of disturbance</td>
<td>Approximately 77.8 hectares (ha)</td>
</tr>
<tr>
<td>Total mined ore tonnage</td>
<td>1.9 million tonnes (Mt)</td>
</tr>
<tr>
<td>Strip ratio (waste:ore)</td>
<td>7.4:1</td>
</tr>
<tr>
<td>Total waste rock</td>
<td>14.1 Mt</td>
</tr>
<tr>
<td>Total material mined (ore plus waste)</td>
<td>16.0 Mt</td>
</tr>
<tr>
<td>Power supply</td>
<td>Via diesel generators</td>
</tr>
<tr>
<td>Product rates (approximately)</td>
<td>DSO: 1,000,000 tpa</td>
</tr>
<tr>
<td>Construction duration</td>
<td>1 to 3 months</td>
</tr>
<tr>
<td>Commencement production</td>
<td>2014 Quarter 4 (Q4)</td>
</tr>
</tbody>
</table>

Note that the estimates provided in Table 1 are based on information available at this time. Some of this information may evolve or change as the detailed design of the proposed action and further investigations are carried out.

**Mining methods**

The near surface ore at the Livingstone deposit, will be extracted by open pit mining methods.

A resource block model developed by Venture Minerals was used to complete pit optimisation studies using Mine 2-4D and Whittle Four-X (Whittle) optimisation software. A mine design was created based on the Whittle results.

The open pit design is based on conventional drill and blast, excavator and truck mining methods. The mining areas will require clearing and grubbing before any mining or construction begins. Topsoil from these areas will be stockpiled for rehabilitation, after the proposed mining is complete.

Mining will progress sequentially from the surface to greater depths. The pits will be mined out in multiple stages to allow for ore to be accessed early and for better equipment fleet utilization. Waste rock will be removed and transported to a designed rock storage facility (RSF). Ore will be transported to a stockpile for crushing.
### Open pit design

The Livingstone pit design parameters are provided below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batter angle (deg.)</td>
<td>70</td>
</tr>
<tr>
<td>Bench height (m)</td>
<td>20</td>
</tr>
<tr>
<td>Ramp gradient</td>
<td>1:10</td>
</tr>
<tr>
<td>Minimum mining width (m)</td>
<td>20</td>
</tr>
<tr>
<td>Berm Width (m)</td>
<td>6</td>
</tr>
<tr>
<td>Ramp Width (m)</td>
<td>15 to 25</td>
</tr>
</tbody>
</table>

Further geo-technical studies are planned to confirm the pit design parameters used in the Whittle and mine design process.

From the Whittle optimisation runs completed, a pit shell containing 1,904,441 t of ore and 14,089,350 t of waste (a waste to ore ratio of 7.40) was selected because it gave an acceptable return per tonne of ore mined. From this shell, a mine design and production schedules were completed. The pit depth is 150 m.

To reduce the truck haulage, two pit ramp exits have been designed.

1. A northern exit, for direct access to the RSF; and
2. A southern exit, for access to the crusher location.

The ramp access was designed to sit on lower elevation walls to reduce the pit size and waste movement, as shown in Figure 2.

![Figure 2 - Plan view of Livingstone Pit design](image-url)
The Livingstone pits will be mined in multiple stages. The separate, small pit to the north of the main pit will be mined at the same time as the main pit.

Further resources at depth are being investigated.

**Open pit schedules**

It has been assumed that mining of the Livingstone pit will be undertaken by a mining contractor using conventional open pit, truck and excavator methods. Venture personnel will maintain responsibility for contract supervision and the technical aspects of the project.

The schedule input parameters for Livingstone are:

- Maximum mining rate of 90 vmpa
- Stage designs lag by a minimum of 30 vm
- Material movement ramped up and down
- Maximum mining rate of approximately 1.2 Mt per month has been applied to total material movement.

**Haulage of ore and waste rock**

Where possible, the alignment of existing tracks will be used to create haul roads and site access roads of an appropriate width and surface to facilitate use by mine vehicles. The main haul road on the site will be from the mine areas to the crusher location, from the mine areas to the RSF and from the crusher location to the external access road.

**Ore processing**

There will be no ore processing on site with ore being crushed and screened prior to loading on to transport for shipping elsewhere.

**Waste rock management**

**Rock storage facility**

The proposed RSF is located to the north of the open pit. Refer to Figure 3.

The RSF has been located close to the pit and has been designed

- To be located in an area where the potential for future mining is minimal
- To have a minimal haulage distance
- To conform with the natural terrain
- With the small northern pit completely backfilled
- With topsoil stripped and stockpiled separately for future rehabilitation
- To stay within the limits of the mining lease and
- To minimise the number of affected catchments.

The design parameters are

- 20 degree batter angle
- 5 m berm every 10 vertical metres and
- To accommodate a capacity of 9.7 Mm$^3$ and to cover an area of 53 ha.
Non acid forming (NAF) rock

Waste rock and ore core samples (84) have been tested for acid drainage potential static tests (Net Acid Production Potential, NAPP and Net Acid Generation, NAG). A subset of 14 samples was also subjected to Toxicity Characteristic Leaching Procedure (TCLP) testing.

Of the 84 samples tested, only one sample (a waste skarn) was found to be potentially acid forming (PAF). All other samples were non-acid forming (NAF).

Detectable trace metals after leaching included barium (0.3 - 1.8 mg/L), lead (<0.1 - 3.9 mg/L), manganese (0.1 - 13.1 mg/L) and zinc (0.1 - 4.1 mg/L).

The risk of acid generation from the mine and waste rock is very low. Nevertheless, appropriate mitigation and management strategies will be implemented to ensure that acid generating conditions are not allowed to form.
**Mine infrastructure and equipment**

All mining infrastructure is contained within the mine lease boundary. Infrastructure for the Livingstone operation will consist of, but is not limited to:

- Open pit, with small northern pit
- Rock storage facility
- Crushing plant
- Stockpile areas (topsoil, run-of-mine ore)
- Lay down yard, workshops and offices
- Road network access
- Explosives magazine
- Abandonment bund.

Figure 4 shows the Livingstone site layout.

Site infrastructure has been based on:

- An abandonment bund, which is derived from 25° and 45° projections up from the final pit floor, to the surface in weathered and fresh material respectively. The intersection point at the surface is then expanded an extra 15 m. The weathering code in the geological model was used to determine projection angles. The bund at this location will be 5 m wide.
- A crusher location allowance of 100 m x 100 m. This space stands 250 m off the pit crest and should allow adequate room for the mobile crushing unit and stockpiles.
- An office block allowance of 100 m x 100 m. These have been located outside a 500 m standoff zone from the magazine location and all pit blasting activities.
- A magazine allowance of 100 m x 50 m, is to allow space for safety mounds between each magazine.
- Four topsoil dump locations around the waste dump at 50 m x 50 m each. This is based on projected disturbance areas of the dump and pits.
- A go-line of 100 m x 50 m, located close to pit operations for ease of access, but outside abandonment zone.
- A road network to provide access to all site elements.

The Livingstone site layout has included considerations for explosive storage and blasting activities. These include:

- A minimum exclusion zone of 500 m to Class B structures (i.e. mine offices)
- The net explosive quantities in each magazine will not exceed 10 t
- There are mounds between magazines
- The crushing areas will be cleared of all personnel during in pit blasting
- The in pit blasting requires the same standoff distance as the magazine.
Figure 4 - Proposed layout for the Livingstone mine project
Equipment

The proposed mining equipment has been based on required production targets, cost structure, mining dilution factors and working terrain. Conventional haul trucks and excavators will be used, with a truck capacity of 80 to 100 t and excavator bucket capacity of 15 to 25 m³. Powered drill rigs with a capacity of up to 200 mm single pass diameter blast holes will be used. The proposed equipment includes:

- 2 x excavators (Hitachi EX2500E)
- 6 x haul trucks (Hitachi EH1700-3)
- 6 x drill rigs (Atlas Copco ROCD9)
- 2 x bull dozers (Cat D9T)
- 1 x water cart
- 1 x service truck
- 1 x stemming loader
- 10 x light vehicles
- 4 x lighting plants
- Mobile crushing and screening plant.

Disturbance footprint

The proposed mining and associated infrastructure will require clearing of approximately 78 ha. Table 2 indicates the proposed area of disturbance based on the current project design.

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pits</td>
<td>15.9</td>
</tr>
<tr>
<td>RSF</td>
<td>52.8</td>
</tr>
<tr>
<td>5m abandonment bund</td>
<td>1.2</td>
</tr>
<tr>
<td>Offices</td>
<td>1.0</td>
</tr>
<tr>
<td>Magazine</td>
<td>0.5</td>
</tr>
<tr>
<td>Go line</td>
<td>0.5</td>
</tr>
<tr>
<td>Crusher/ ROM</td>
<td>1.0</td>
</tr>
<tr>
<td>Roads</td>
<td>4.9</td>
</tr>
<tr>
<td>Total</td>
<td>77.8</td>
</tr>
</tbody>
</table>

Mine water management

A conceptual groundwater model has been developed for the Livingstone project and eleven monitoring bores at eight sites have been installed to allow water level measurements and groundwater quality sampling. Bore locations are shown in Figure 5 and borehole characteristics are provided in Table 3.
Figure 5 – Groundwater sampling locations
Table 3 - Summary of groundwater monitoring bore characteristics

<table>
<thead>
<tr>
<th>Bore</th>
<th>Easting</th>
<th>Northing</th>
<th>Elevation (mASL)</th>
<th>Depth drilled (m)</th>
<th>Summary log /remarks</th>
<th>Water zones (m)</th>
<th>Water yield (L/sec)</th>
<th>Water EC (µS/cm)</th>
<th>Screened interval (m)</th>
<th>K (m/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWLV1A</td>
<td>357100</td>
<td>5383200</td>
<td>265</td>
<td>48</td>
<td>0 - 43 dolomite; 43 - 48 serpentinised skarn (E); 8 - 13 dolomite (E)</td>
<td>5 - 30; 43-48 (dry 30-43)</td>
<td>5</td>
<td>400</td>
<td>10 - 13 (50mm diam)</td>
<td>3</td>
</tr>
<tr>
<td>GWLV1B</td>
<td>357110</td>
<td>5383200</td>
<td>265</td>
<td>13</td>
<td>0 - 5 soil/alluvium; 5 - 8 serpentinised skam; 8 - 13 dolomite (E)</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>10 - 13 (50mm diam)</td>
<td>1</td>
</tr>
<tr>
<td>GWLV2</td>
<td>357110</td>
<td>3583130</td>
<td>269</td>
<td>36</td>
<td>0 - 16 sandstone; 16 - 23 clay; 23 - 36 sandstone, siltstone (E)</td>
<td>18+</td>
<td>0.1</td>
<td>130</td>
<td>32 - 35 (50mm diam)</td>
<td>0.5</td>
</tr>
<tr>
<td>GWLV3</td>
<td>356940</td>
<td>5383265</td>
<td>286</td>
<td>48</td>
<td>0 - 4 soil/alluvium; 4 - 12 quartzite; 12 - 15 serpentinised skarn; 15 - 20 dolomite; 20 - 25 gossan; 25 - 48 dolomite (E)</td>
<td>10+</td>
<td>10+</td>
<td>125</td>
<td>34 - 46 (125mm diam)</td>
<td>10</td>
</tr>
<tr>
<td>GWLV4A</td>
<td>357280</td>
<td>5382805</td>
<td>251</td>
<td>72</td>
<td>0 - 5 soil/alluvium; 5 - 12 sandstone, siltstone (E); 12 - 22 clay (weathered granite, Dg); 22 - 48 claystone; 48 - 57 dolomite; 57 - 60 serpentinised skarn; 60 - 70 quartzite; 70 - 72 dolomite (E)</td>
<td>65 - 70</td>
<td>5</td>
<td>380</td>
<td>60 - 72 (125mm diam)</td>
<td>3</td>
</tr>
<tr>
<td>GWLV4B</td>
<td>357280</td>
<td>5382805</td>
<td>251</td>
<td>27</td>
<td>0 - 27 as for GWLV4A; nested in same hole with GWLV4C</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>23 - 26 (50mm diam)</td>
<td>1</td>
</tr>
<tr>
<td>GWLV4C</td>
<td>357280</td>
<td>5382805</td>
<td>251</td>
<td>48</td>
<td>0 - 48 as for GWLV4A; nested in same hole with GWLV4B</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>44 - 47 (50mm diam)</td>
<td>1</td>
</tr>
<tr>
<td>GWLV5</td>
<td>357230</td>
<td>5383055</td>
<td>262</td>
<td>48</td>
<td>0 - 2 soil/alluvium; 2 - 44 sandy clay (weathered granite, Dg); 44 - 48 granite (Dg)</td>
<td>3+</td>
<td>&lt;0.1</td>
<td>ND</td>
<td>44 - 47 (50mm diam)</td>
<td>0.1</td>
</tr>
<tr>
<td>GWLV6</td>
<td>357200</td>
<td>5382890</td>
<td>256</td>
<td>108</td>
<td>0 - 3 soil/alluvium; 3 - 29 clay (weathered granite, Dg); sandstone, siltstone, claystone (some ferricrete) (E)</td>
<td>3+</td>
<td>0.7</td>
<td>50</td>
<td>104 - 107 (50mm diam)</td>
<td>0.5</td>
</tr>
<tr>
<td>GWLV7</td>
<td>357210</td>
<td>5382950</td>
<td>258</td>
<td>42</td>
<td>0 - 4 soil/alluvium; 4 - 12 mudstone; 12 - 19 dolomite; 19 - 42 serpentinised skarn and dolomite (E)</td>
<td>5+</td>
<td>0.5</td>
<td>390</td>
<td>38 - 41 (50mm diam)</td>
<td>0.5</td>
</tr>
<tr>
<td>GWLV8</td>
<td>357210</td>
<td>5382960</td>
<td>258</td>
<td>72</td>
<td>0 - 72: sandstone, siltstone (E)</td>
<td>3+</td>
<td>0.3</td>
<td>ND</td>
<td>54 - 60 (125mm diam)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Column notes
1 Bores drilled by Spaulding Drillers January and February 2012; six sites; eleven bores
2 Datum for grid coordinates is GDA94. Bore locations currently unsurveyed.
3 mASL = metres above sea level; bore elevations currently unsurveyed
4 Є = Cambrian Crimson Creek Formation; Dg = Devonian Meredith granite
5 Est. yield is air-lifted flow measured at end of hole
6 EC = water electrical conductivity, measured on air lifted flow at end of hole
7 K = hydraulic conductivity, estimated from slug testing of screened interval of hole. Test analyses are continuing and K values are preliminary.
8 Permeability testing and groundwater sampling has been undertaken, and extraction-scale pump testing is being undertaken at one of the eight sites, to help estimate groundwater flow to the open pit and to refine the numerical groundwater modelling. Bore characteristics are provided in Table 3. Preliminary results indicate permeability ranges over two orders of magnitude (approx. 0.1 - 10 m/day), which is not unexpected given the variable, steeply-dipping lithology.
9 The conceptual groundwater model for the Livingstone area is a single, unconfined, fractured rock aquifer which drains towards Lake Pieman at a regional scale, to Stanley River at an intermediate scale, and to Livingstone Creek and tributaries at a local scale.
10 A numeric groundwater model for the site is being developed in accordance with Australian groundwater modelling standards using MODFLOW-2000. It incorporates a finite difference mesh with grid refinement in the proposed pit area. Six model layers have been included to account for the steeply dipping beds which impact the vertical and lateral hydraulic conductivity. Groundwater observation bores, stream monitoring and climate station data will be incorporated into the model.
The modelling is being undertaken in two phases, using Visual Modflow 2010. The first phase involves the calibration of a multi-layer near-steady state groundwater model. The second phase will further refine and expand on the outputs and will build on the conceptualisation and the datasets used in the near-steady state model to develop a fully calibrated multi-layer transient groundwater model of the proposed mine site.

The model will be used to assist the preparation of the conceptual mine plan and mine water management system, which will be developed and described in the DPEMP.

While the diversion drains will divert surface water around the pit, there is expected to be an inflow of groundwater into the pit. This, together with incipient rain water, will need to be pumped out to keep the pit dry while it is operating.

The proposed sampling and modelling will allow the dewatering volumes and rates to be predicted, and a water budget and appropriate discharge regime to be developed.

Product transport
All site roads will need to be constructed to an appropriate standard based on their function.

Livingstone ore will be crushed by a mobile crushing and screening plant to 10 mm. Crushed ore will then be loaded on to road trains and transported, via road and local rail, to the port in Burnie. It will then be shipped for smelting elsewhere.

The Livingstone ore will be transported from site roads, to the public Pieman road, before being loaded onto rail at the proposed Bastyan Dam rail siding for transport by rail to Burnie. Figure 4 shows the site roads. Figure 1 shows the location of the Bastyan rail siding.

2.5 Stakeholder Consultation
Venture Minerals has undertaken consultation with key stakeholders, including:

- Municipal councils and organisations:
  - West Coast Council
  - Waratah-Wynyard Council
  - Burnie City Council
  - Tullah Progress Association
  - Cradle Coast Authority.

- State and Federal Members of Parliament.

- State Government Departments:
  - Department of Infrastructure, Energy and Resources (including Mineral Resources Tasmania)
  - Department of Primary Industries, Parks, Water and Environment (including Aboriginal Heritage Tasmania)
  - Department of Economic Development, Tourism and the Arts.

- Commonwealth Government Departments:
  - Department of Sustainability, Environment, Water, Populations and Communities.

- State Authorities:
  - Tasrail
  - Tasports
  - Forestry Tasmania.
Other mining companies:
- Grange Resources
- Minerals and Metals Group (MMG)
- Metals X
- Shree Minerals
- Bass Metals
- Tasmanian Magnesite.

Other organisations:
- Save the Devil Program.

2.6 Physical environment

2.6.1 Existing environment

Topography
The proposed mining lease area comprises of hill slopes on the western, northern and eastern sides, while the central and southern portions are predominantly low lying and dominated by drainage lines that feed into the Stanley River. Livingstone Creek runs through the central section of the mining lease area (MLA).

Geology
The Livingstone Skarn is hosted by the Neoproterozoic Success Creek Group within the southern contact metamorphic aureole of the Meredith Granite. The Meredith Granite is part of a suite of Devonian granites which is very important to a range of mineral deposits in Tasmania.

Deposits associated with this suite include world class tin and tungsten ore bodies, as well as many lead, silver, gold, zinc, copper, nickel, iron, fluorite and bismuth deposits of different styles which are genetically and spatially related to the emplacement of these granites in Western Tasmania.

The styles of mineralisation associated with the Devonian granitoids include stratabound carbonate replacement, cassiterite-massive sulphide, silicate and magnetite skarns, and disseminated and vein deposits.

The Success Creek Group generally contains four recognisable formations for a combined thickness of 950 m. These comprise:

- basal conglomerate with sandstone lenses
- overlying quartz sandstone with minor siltstone and conglomerate (Dalcoath Formation)
- black mudstone, siltstone and minor quartz sandstone, and
- red chert and mudstone with minor quartz sandstone, conglomerate and dolomite (Renison Bell Formation).

The Meredith Granite underlies the Livingstone project area. The margin of the Meredith Granite dips at a modest angle away to the south beneath the Success Creek Group but is highly irregular in detail with numerous dykes and apophyses which appear to stop the meta-sedimentary units. Large rafts of skarn and hornfels also occur within the margins of the main granite body. Preliminary interpretation suggests several phases of granite intrusion culminating in late stage quartz-tourmaline veining and the localised development of quartz-tourmaline greisen.
The Livingstone DSO Deposit is predominately composed of hematite which is a weathering (oxidation) product of magnetite within the Livingstone Skarn. The deposit is a gossanous hematite rich body that plunges parallel to the low angle granite contact from surface to a depth of over 150 m below the surface. A small near surface section of the deposit has been off-set by faulting to the north east.

**Climate**

A new weather station was installed at the nearby Mt Lindsay site in March 2011. Data being collected includes rain, evaporation, humidity, temperature and wind speed. The aim of the station, in addition to accumulating longer-term climatic records, is to provide shorter-term, site specific information to assist in hydrogeological water balance assessments and management issues such as stream flows, diversions and mine dewatering.

The closest Bureau of Meteorology (BOM) station is located at Rosebery (HEC substation). This site operated from 1979 to 1993, when it closed. This site is approximately 18 km southeast of the mine site at an altitude of 165 m.

The rainfall and temperature data (from the Rosebery site) are summarised as follows:

- **Mean annual rainfall** 1949.4 mm/year
- **Maximum mean monthly temperature** 16.4 °C
- **Minimum mean monthly temperature** 7 °C.

The prevailing winds at the site are north westerly to south westerly. Refer to Table 4 for the monthly rain and temperature statistics for the Rosebery station.

**Table 4 - Monthly rainfall and temperature**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall Highest (mm)</td>
<td>291</td>
<td>190.2</td>
<td>187.4</td>
<td>306.3</td>
<td>318</td>
<td>291.2</td>
<td>315.7</td>
<td>424.4</td>
<td>500.9</td>
<td>500.6</td>
<td>221</td>
<td>277.9</td>
<td>2189</td>
</tr>
<tr>
<td>Rainfall Mean (mm)</td>
<td>129.5</td>
<td>81.6</td>
<td>102.8</td>
<td>150.7</td>
<td>172.7</td>
<td>199.9</td>
<td>208.7</td>
<td>211.1</td>
<td>233.2</td>
<td>189.7</td>
<td>147.0</td>
<td>134.5</td>
<td>1949.4</td>
</tr>
<tr>
<td>Rainfall Median (mm)</td>
<td>120.1</td>
<td>62.5</td>
<td>96.3</td>
<td>140.3</td>
<td>167.7</td>
<td>207.8</td>
<td>229.8</td>
<td>193.4</td>
<td>214.8</td>
<td>149.8</td>
<td>146.3</td>
<td>106.1</td>
<td>1943.7</td>
</tr>
<tr>
<td>Rainfall Lowest (mm)</td>
<td>53</td>
<td>27.6</td>
<td>42</td>
<td>66</td>
<td>96.6</td>
<td>94</td>
<td>96.4</td>
<td>114.4</td>
<td>106</td>
<td>82.2</td>
<td>45.4</td>
<td>36.4</td>
<td>1561.4</td>
</tr>
<tr>
<td>Temperature Mean maximum (^\circ\text{C})</td>
<td>21.0</td>
<td>21.9</td>
<td>20.1</td>
<td>17.0</td>
<td>14.1</td>
<td>11.3</td>
<td>11.0</td>
<td>12.1</td>
<td>13.3</td>
<td>16.4</td>
<td>18.6</td>
<td>20.5</td>
<td>16.4</td>
</tr>
<tr>
<td>Temperature Mean minimum (^\circ\text{C})</td>
<td>10.1</td>
<td>9.7</td>
<td>9.2</td>
<td>7.7</td>
<td>6.2</td>
<td>4.3</td>
<td>3.5</td>
<td>4.3</td>
<td>5.0</td>
<td>6.4</td>
<td>7.7</td>
<td>9.6</td>
<td>7.0</td>
</tr>
</tbody>
</table>
hydrology and groundwater hydrology. Previous to this investigation, Coffey Environments undertook baseline water quality monitoring during 2008 and 2009.

**Surface water**

During 2008 and 2009, preliminary water quality monitoring in the Stanley River catchment was undertaken by Coffey Environments – just upstream at the Stanley River Bridge on the Pieman Road, and at the lower end of Livingstone Creek at its confluence with Stanley River. Four quarterly sampling runs were conducted.

The 2008 and 2009 testing showed that, like the streams on Mt Lindsay to the east, the Stanley River catchment watercourses waters are very low salinity, slightly acidic sodium chloride types with relatively high levels of aluminium, and copper. Sulphate was less than 5 mg/L in all samples. The pH of all waters ranged from 3.5 to 6.2, which is slightly more acidic than the Mt Lindsay streams, and probably relates to the Meredith Granite as a basement rock.

Since June 2011, a hydrogeological program has been progressing at the site, with additional sampling sites added. Surface water and groundwater sampling is continuing, groundwater monitoring bores have been installed and permeability tested, and a numerical 3D computer model of the proposed mine site and environs is being developed.

Surface water sampling stations are shown in Figure 6.

Based on the adopted rainfall and evaporation data, and a runoff coefficient of about 60%, the annual discharge from the main stream and its minor tributaries flowing through the Livingstone catchment to Stanley River is estimated at 6,000ML (6 GL), from a catchment area of about 4.5 km².

At each of the four surface water monitoring sites on Livingstone Creek and Stanley River (LC1, LC2, SR1 and SR2), submerged data loggers record water depth, which, correlated with flow rates, provide estimates of discharge. The data are currently being analysed.

Three sampling events were conducted by Coffey Environmental in 2008 - 2009, and four events have since occurred on July and September 2011 and January and April 2012.

Chemically, the surface waters are slightly acid to acid pH (range 4 - 6), sodium-potassium chloride types of very low salinity (electrical conductivity about 50 - 100 µS/cm). Alkalinity is generally less than 2 mgCaCO₃/L, and acidity about 5 - 10 mgCaCO₃/L.
Groundwater

As described earlier, groundwater bores have recently been installed in the Livingstone project area (Figure 5) and sampling and monitoring have commenced.

Groundwater behaviour at Livingstone is likely to be similar to that of the adjacent Mt Lindsay area, which is contained in a single, unconfined, fractured rock aquifer which drains towards Lake Pieman at a regional scale but to watercourses at a local scale. The water table at Mt Lindsay fluctuates by up to several metres annually and responds within about 2 days to rain events exceeding about 10 mm/day.

Land systems

There are three land systems mapped within the proposed project area. The Land Systems of the area, as mapped by Richley¹, are as follows.

841351 Mt Heemskirk

This land system covers the majority of the project area. Jointing has resulted in a parallel arrangement of steep-sided rocky ridges. The soils are mainly organic and peat forms a surface layer even on those profiles dominated by the mineral fraction. The granitic soils are typically highly erodible, on steep slopes.

¹ Richley, LR. 1978. Land Systems of Tasmania Region 3. Tasmanian Department of Agriculture.
**824241 Huskinson River**

This land system runs along the eastern side of the of the project site area. It has Cambrian greywake turbidite sequences and some basic-intermediate volcanic rocks. Soils on the steeper slopes vary greatly in depth with profiles from less than half to greatly in excess of two metres. Soils on side slopes have formed on gravelly colluvium. The steep topography of this land system means a high sheet erosion hazard exists on the steep slopes with the consequent risk of siltation along the flowlines.

**813251 Balfour**

This land system runs along the southern western area of the project site. It is characterised by steep ridges of siliceous Precambrian material. It is predominantly covered by shallow, sandy organic soils, but brownish yellow clay soils have developed on areas of mudstone. The soil erosion hazard is high over most of the system.

**Land capability**

There has been no land capability survey of the area undertaken.

**Land tenure and land values**

All of the project area is located within the Meredith Range Regional Reserve (Crown Land), which is vested in the Department of Primary Industries Parks Water and Environment.

Under the terms of the *National Parks and Reserves Management Act 2002*, the name Regional Reserve is applied to an area of land with high mineral potential or prospectivity and predominantly in a natural state.

The Meredith Range Regional Reserve covers an area of some 66,920 ha, with the disturbed project area (78 ha), therefore covering some 0.1% of the total Reserve area.

The management objectives for Regional Reserves in accordance with *Nature Conservation Act 2002* include: to provide for mineral exploration activities and utilisation of mineral resources. The development of the mine will be consistent with the Reserve’s management objectives.

There is one small area on the south eastern corner of the mining lease which is vested in the Hydro Electric Corporation.

**Flora and Fauna**

A flora and fauna habitat assessment of the proposed mine lease area (MLA) was undertaken in 2011 by North Barker Ecosystem Services². A summary of the report is provided below.

**Vegetation communities**

The hill slopes of the MLA are dominated by myrtle rainforest and western peppermint forest, and to a lesser extent buttongrass moorland on south-eastern slopes. The lower lying central and southern section is dominated by western peppermint forest, which occurs along the drainage lines and in the lower, wetter areas, and western wet scrub and buttongrass moorland, which are likely to occur on poorer, less fertile but still poorly drained soils.

---

² North Barker Ecosystem Services, (February 2012) *Livingstone Mine Proposal, Botanical Survey and Fauna Habitat Assessment*. 
Six vegetation communities were recorded in the mining lease area:

- *Nothofagus* rainforest undifferentiated (RMU)
- *Eucalyptus nitida* forest over *Leptospermum* (WNL)
- Buttongrass moorland with emergent shrubs (MBS)
- Western wet scrub (SWW)
- *Acacia melanoxylon* forest on rises (NAR)
- *Leptospermum* scrub (SLW).

None of the vegetation communities recorded are listed as threatened under the Tasmanian *Nature Conservation Act 1995*. Refer to Table 5 for the extent and reservation status of vegetation communities within the project area. Figure 7 shows the extent of each vegetation type.

The following provides a description of each community.

**Nothofagus rainforest undifferentiated (RMU)**

This community covers approximately 155 ha within the MLA and occurs predominantly on the northern and eastern hill slopes on areas of higher soil fertility. The height and composition of this community varies considerably on site and is most likely influenced by past fire history. In the taller rainforest, the canopy trees are in excess of 30 m tall with mature old growth being the dominant species, whereas in the shorter rainforest, the canopy trees are up to 20 m tall, with a mix of dominant species.

This community is well reserved and not threatened.

**Eucalyptus nitida forest over Leptospermum (WNL)**

This community covers approximately 133 ha within the MLA and is widespread, occurring across a broad range of site conditions. It occurs along drainage lines, within the lower lying areas and also on the lower hill slopes to the north, east and west. *Eucalyptus nitida* is the dominant canopy species within this community.

This community is well reserved and not threatened.

**Buttongrass moorland with emergent shrubs (MBS)**

This community covers approximately 46 ha and occurs in the central low lying area, and the slopes of the south-western part of the project area. It occurs on soils of poor quality. This community consists of a dense sedge layer, with emergent layer of shrubs which vary in density.

This community is well reserved and not threatened.

**Western wet scrub (SWW)**

This community covers approximately 24 ha and occurs in the low lying area of the northern part of the mining lease area. Western scrub has many species common to the *Eucalyptus nitida* forest over *Leptospermum* (described above) except with the eucalyptus being only occasional or absent. The drainage in this area of western wet scrub is impeded and this is the most likely reason the eucalyptus are absent. The community is a very dense, almost impenetrable, uneven scrub.

This community is well reserved and not threatened.
**Acacia melanoxylon forest on rises (NAR)**

This community covers approximately 6 ha and occurs as a single distinct patch on the eastern hill slope. This community is likely to be disturbance induced early successional stage of the extensive rainforest of the region, with evidence of historic mining activities found within this community. The soil in this area is fertile and well drained. The canopy trees are 25-30 m in height and are dominated by *Acacia melanoxylon*.

This community is well reserved and not threatened.

**Leptospermum scrub (SLW)**

This community covers approximately 3 ha and occurs as a thin strip on the southern edge of the MLA along the Pieman Road. The area is likely to have been used as a stockpile/storage area during construction of the Pieman Road, with the current vegetation community being the result of the regeneration of plants once the site was abandoned.

*Leptospermum scrub* contains occasional emergent *Eucalyptus nitida* trees over a dense and diverse shrub layer. This community is well reserved and not threatened.

**Table 5 - Extent and reservation status of vegetation communities**

<table>
<thead>
<tr>
<th>TASVEG Community&lt;sup&gt;3&lt;/sup&gt; and extent in MLA</th>
<th>State-wide&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Bioregional&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Nothofagus</em> rainforest undifferentiated (RMU) 155 ha</td>
<td>606,400 ha intact, 504,400 ha reserved = 83% reserved Not threatened, Well reserved</td>
<td>378,600 ha intact, 339,000 ha reserved = 90% reserved Not threatened, Well reserved</td>
</tr>
<tr>
<td><em>Eucalyptus nitida</em> forest over Leptospermum (WNL) 133 ha</td>
<td>109,700 ha intact, 107,100 ha reserved = 98% reserved Not threatened, Well reserved</td>
<td>86,800 ha intact, 85,200 ha reserved = 98% reserved Not threatened, Well reserved</td>
</tr>
<tr>
<td>Buttongrass moorland with emergent shrubs (MBS) 46 ha</td>
<td>87,200 ha intact, 84,600 ha reserved = 97% reserved Not threatened, Well reserved</td>
<td>70,200 ha intact, 69,200 ha reserved = 99% reserved Not threatened, Well reserved</td>
</tr>
<tr>
<td>Western wet scrub (SWW) 24 ha</td>
<td>139,400 ha intact, 124,700 ha reserved = 90% reserved Not threatened, Well reserved</td>
<td>112,000 ha intact, 102,300 ha reserved = 91% reserved Not threatened, Well reserved</td>
</tr>
<tr>
<td><em>Acacia melanoxylon</em> forest on rises (NAR) 6 ha</td>
<td>18,700 ha intact, 8,000 ha reserved = 43% reserved Not threatened, Well reserved</td>
<td>6,300 ha intact, 4,000 ha reserved = 64% reserved Not threatened, Well reserved</td>
</tr>
<tr>
<td><em>Leptospermum</em> scrub (SLW) 3 ha</td>
<td>76,200 ha intact, 51,300 ha reserved = 67% reserved Not threatened, Well reserved</td>
<td>41,700 ha intact, 35,500 ha reserved = 85% reserved Not threatened, Well reserved</td>
</tr>
</tbody>
</table>

---

<sup>3</sup> Harris & Kitchener 2005  
<sup>4</sup> DPIPWE 2010  
<sup>5</sup> DPIPWE 2010
Figure 7 - Distribution of vegetation communities
**Threatened flora species**

A total of 112 vascular plant species were recorded from within the project area, including 26 endemic species. No introduced species were recorded.

A paucity of aquatic flora was recorded as the Stanley River was in flood and other small creeks were generally small and fast flowing thus restricting the ability of aquatic flora species to grow there.

No threatened vascular plant species listed under the schedules of the Tasmanian Threatened Species Protection Act 1995 (TSPA) or the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 were recorded from within the study area. There will therefore be no impacts from site infrastructure on threatened flora species.

**Threatened lichens**

*Menegassia minuta* (lichen) is a tiny, flat, leafy lichen that is endemic to Tasmania and is classified as endangered under the TSPA. It is restricted to the canopy twigs of *Eucryphia lucida* (leatherwood) trees in thamnic rainforest in north west of Tasmania.

It has previously only been found in two locations - one in the northern Tarkine region (Sumac) and the other south of Tullah near Mt Black. Both of these collections were made from logging coupes in felled trees.

Leatherwood trees were commonly recorded in the MLA within rainforest. However, rainforest suitable for logging is restricted to the tall rainforest types (in this case thamnic). No tall rainforest occurs within the proposed pit area.

Despite searches in thousands of locations over 20 years only two records exist. Given this and that there is no tall rainforest in the pit area the probability of it occurring there is very low.

**Introduced plants**

No weed species were recorded during the July survey within the Livingstone MLA. However, in the old quarry site of the adjacent proposed Mt Lindsay mining lease, canary broom and gorse were recorded.

The presence of Spanish heath along the Pieman Road (outside of the Livingstone MLA) is a threat to the MLA. A weed management plan for the MLA should include Spanish heath along the Pieman Road to avoid introducing a declared weed that thrives in disturbed areas and roadsides.

The remainder of the MLA is currently weed free, highlighting the importance of strict hygiene controls on machinery and soil/gravel brought in to the site, and on having a management plan in place to control any outbreaks should they occur.

**Plant pathogens**

*Phytophthora cinnamomi*

*Phytophthora cinnamomi* is a soil borne fungal pathogen that invades the roots of plants and starves them of nutrients and water. Heath communities are the most susceptible to infection with a consequent serious loss of species diversity. It is generally spread by the transportation of soil on vehicles, construction machinery and walking boots.
The Livingstone MLA is considered to be in an area that is susceptible to *Phytophthora cinnamomi* both in terms of conducive conditions and vegetation susceptibility. This is particularly the case with vegetation communities that contain heathy vegetation such as from the genera *Banksia, Epacris, Hakea, Hibbertia, Leptospermum, Melaleuca, Monotoca, Pultenaea, Richea, Sprengelia* and *Xanthorrhoea*. Within the site communities containing large amounts of these genera are *Eucalyptus nitida* forest over *Leptospermum*, Buttongrass moorland with emergent shrubs and Western wet scrub. This equates to approximately 55% of the MLA being highly susceptible to *Phytophthora*. Nothofagus rainforest undifferentiated and *Acacia melanoxylon* forest on rises, and *Leptospermum* scrub contain less of these genera and are considered to be much less susceptible as communities.

Symptomatic evidence of *Phytophthora* was observed in one area of Buttongrass moorland adjacent to the main access track to the western side of the MLA. Dead and dying individuals of *Banksia marginata* (silver banksia), *Hakea epiglottis* (beaked hakea) and *Sprengelia incarnata* (pink swampheath) were observed.

**Myrtle Wilt (Chalara australis)**

*Chalara australis* is a naturally occurring fungus that causes disease in mature myrtle beech (*Nothofagus cunninghamii*) and regenerating trees (40-60 years), which results in death of the trees. It is commonly referred to as ‘myrtle wilt’.

Symptoms of myrtle wilt were not seen in the study area. The tall open rainforest that occurs throughout the study area is the most susceptible of rainforest types.

Plant hygiene measures will be implemented to prevent the introduction and/or spread of introduced plant species, weeds, pests and diseases.

**Fauna**

**Fauna habitat**

The study area contains a range of fauna habitats including rainforest, eucalypt forest, blackwood forest, scrub, buttongrass moorland and the aquatic environments of the Stanley River. The complex structure of the habitat on site provides suitable habitat for a range of bush birds and mammals.

Although the majority of the MLA was considered unsuitable as nesting habitat for wedge-tailed eagles, during the on-ground survey several areas were highlighted as having the potential to support wedge-tailed eagle nests. Potential nesting habitats were surveyed by helicopter on 20th July 2011. The trees that were considered potentially suitable did not contain wedge-tailed eagle nests. Consequently wedge-tailed eagles are not considered in further detail.

The absence of old growth eucalypt trees means a lack of nesting and roosting habitat for hollow using fauna and eagles. However, logs and hollowed bases in mature myrtle are potential habitat for mammals, particularly quolls and devils, and deep litter is prevalent on the ground which is favourable for invertebrates. Burrowing crayfish soil chimneys were frequently found in the lower lying wetter areas.

**Threatened fauna for which the habitat could be significant**

There are three listed fauna species for which the habitat at the site could be considered significant. These are outlined below.

**Tasmanian Devil (Sarcophilus harrisii)**

The Tasmanian devil is a marsupial carnivore and scavenger that inhabits forest, woodland and agricultural areas across Tasmania. The devil is generally nocturnal and
during the day it will retire to a cave/den, hollow log or thick scrub. At night it forages over a range of 10 to 20 hectares. The animal is solitary but not territorial and foraging areas may overlap considerably.

The Tasmanian devil was listed on both the TSPA and the EPBCA following significant impact of the Devil Facial Tumour Disease (DFTD) on the population.

The species is not currently threatened by habitat loss and has proven to be tolerant of habitat modification by breeding successfully in human domestic environments, such as under houses and sheds. However, due to the reduction in numbers caused by DFTD increasing importance is placed upon the protection of maternal dens so that breeding opportunities and successes are maximised.

The study area is considered to support Tasmanian devils as evidenced by a scat found during the recent survey. However, they are probably at low density due to the predominance of rainforest habitat with a low density of prey animals.

The mature tall rainforest has the potential to support dens in the hollows at the bases of large myrtles or in shelters created under fallen logs. No rocky outcrops with suitable shelters were seen during the survey. The vegetation communities other than rainforest have a lower potential for containing any dens as there is much lower likelihood of mature trees present with hollow bases. Some areas of vegetation were too dense to search satisfactorily.

Removal of native vegetation (disturbance footprint approximately 78 ha) for the proposed mine development will reduce the local foraging area, although the vegetation is not considered to be denning habitat. The quantity of vegetation removal will affect the carrying capacity of the area to support devils, therefore there will be an impact on devils. However, because of the very large extent of continuous similar habitat in the immediate vicinity the impact is likely to be insignificant.

Given the area of their home ranges, the area of the vegetation clearance required for the mine is likely to be only a small proportion of any given devil’s range.

An increase in traffic volume to and from the site has the potential to result in a higher incidence of road kill or injury to the species.

**Spotted-tailed quoll (Dasyurus maculatus maculatus)**

The spotted-tailed quoll is a medium-sized carnivorous marsupial found in southeastern mainland Australia and in Tasmania. Their numbers have declined on the mainland and Tasmania is now their stronghold.

The spotted-tailed quoll is most abundant in areas containing rainforest, wet forest and blackwood swamp forest. The core range for the quoll is lowland forested areas of the north bounded by Wynyard, Gladstone and the central and northeastern highlands. Lower densities of animals occur elsewhere in suitable habitat throughout Tasmania.

Spotted-tailed quoll have not been recorded from within 5 km of the study area; however, this is most likely due to lack of survey and the impenetrable terrain and remoteness of the site. A scat considered likely to be from a spotted-tailed quoll was found during the survey.

The study area is considered to have high foraging habitat value for the spotted-tailed quoll. The areas of rainforest in particular are considered to have a moderate

---

6 North Barker Ecosystem Services (February 2012) Livingstone Mine Proposal, Botanical Survey and Fauna Habitat Assessment.
possibility of supporting a spotted-tailed quoll den. The MLA is considered likely to be part of a home range for this species, albeit outside of the core range.

The area of disturbance of the mine and associated infrastructure will result in a loss of spotted-tailed quoll foraging habitat. However, the approximately 80 ha that will be lost is only about one quarter of the typical home range size of a single female quoll. Any individual quoll that uses the site will be a member of a population and quoll populations occupy at least 15,000 ha of habitat. There is well in excess of this area of habitat in the immediate vicinity of the site and the loss of only 80 ha (0.5%) out of more than 15,000 ha is very unlikely to have a significant impact on the population.

An increase in traffic volume to and from the site has the potential to result in a higher incidence of road kill or injury to the species.

Grey goshawk (Accipiter novaehollandiae)

The Tasmanian morph of the grey goshawk is exclusively white in colour. It is typically associated with rainforest, wet forest and swamp forests with a preference for nesting in blackwoods (Acacia melanoxylon). While blackwoods are preferred for nesting trees, other trees including mature myrtles (Nothofagus cunninghamii) will also be utilised. Nest sites are often, although not exclusively, reused in following seasons.

Blackwood swamp forest and stream side blackwood forest in the north west of Tasmania has been identified as a key habitat area for the grey goshawk. A significant patch (6 ha) of Acacia melanoxylon forest on rises (NAR) supporting mature blackwoods was found in the study area. This patch was also considered open enough to be suitable for the movement of grey goshawks. Mature myrtle trees in the adjacent tall rainforest could also be utilised as nesting trees. Suitable nesting habitat is therefore considered to be present.

No records of this species occur within 5 km from the study area. The nearest known nest occurs approximately 36 km to the south. No goshawks were located in or adjacent to the MLA.

Two large nests were found within the canopy of mature blackwood trees in the patch of NAR, during the survey. At the time of survey (early July 2011) there was no activity observed at the nests, therefore the occupants could not be confirmed. It is considered, however, that they are potentially grey goshawk nests from their size, position in the canopy and the habitat that they occur in.

The patch of NAR will be excluded from any mine activities and hence there will be no impact on the potential grey goshawk nests.

Aboriginal cultural heritage

Cultural Heritage Management Australia (CHMA) undertook An Aboriginal Cultural Heritage Assessment of the Stanley River Mining Lease Area, North-West Tasmania, in July 2011. A summary of the report is provided below.

As part of the background review of the project area, a search of the Tasmanian Aboriginal Site Index (TASI) resulted in no registered Aboriginal heritage sites identified within the study area boundaries. The closest known site is situated over 20 km to the west of Mount Lindsay.

The field survey was undertaken in 2011 by Stuart Huys (CHMA) and Vernon Graham (Aboriginal Heritage Officer). Approximately 16.2 km of survey transects were walked within the bounds of the study area.

No archaeological sites or areas of potential archaeological sensitivity were identified during the field assessment.
It is acknowledged that surface visibility throughout much of the study area was constrained due to thick vegetation cover. However, there are a series of vehicle tracks that run through numerous parts of the study area, and these tracks provided transects where there were improved conditions of surface visibility. These vehicle tracks traversed all landscape units present within the study area and provided 30,000 m² of effective survey coverage.

The fact that no Aboriginal heritage sites were identified along this extensive network of tracks provides a very clear indication that site and artefact densities within the study area are generally very low.

No suitable stone material sources for artefact manufacturing was identified within the bounds of the study area, and the river margins are generally steeply incised, making access difficult and camping undesirable. This, combined with the dense nature of the vegetation structure throughout much of the study area, would probably explain the apparent sparse level of Aboriginal activity in the area.

Due to the very sparse Aboriginal activity within the area, the archaeological sensitivity of the study area is correspondingly very low.

Based on the findings of this investigation, there are no site specific heritage constraints or requirements for the proposed mine development.

**Historic heritage**

A *Historic Heritage Desktop Assessment, Stanley River, Tullah*, was prepared by Austral Tasmania in July 2011. This report found an intensive period of mining development on the Stanley River tin field from the late nineteenth through to the early twentieth century. The strong conclusion drawn from the historical research is that the former Stanley River Reward sections were the most intensively developed parts of the study area. Lower levels of development took place along News and Livingstone creeks.

Consequently a field survey to identify, record and assess sites of potential historical heritage significance was undertaken by Austral Tasmania, titled, *Historic Heritage Assessment, Stanley River, Tullah, October 2011*. The following information is from the above reports.

There were no historic heritage sites within or adjacent to the study area that were entered on the following lists:

- Tasmanian Heritage Register
- Tasmanian Historic Places Inventory
- West Coast Planning Scheme’s Table 19.1 Items and Places of Heritage Significance
- Forestry Tasmania’s database.

There is one site (the Tarkine nomination) listed on National Heritage Register. The study area is within the nominated area of the Tarkine.

The study area is situated in a region of historical mining activity, dating from the late nineteenth century. Considerable interest existed in the mineral prospects of the Stanley River tin field, in the late nineteenth century, and what followed was a rapid, but quite short lived boom in speculative claims, prospecting and mining activity. Attempts to establish viable mining operations in the area failed for a range of reasons, including access and transport problems, the lack of water, and financial downturn.

The field survey identified 47 sites, with the site types broadly divided into sites related to historic occupation and sites related to historic mining activity. Refer to Table 6 below for a list of the identified sites.
<table>
<thead>
<tr>
<th>Site Number</th>
<th>Name</th>
<th>Historic Value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stanley Reward Alluvial Workings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 a</td>
<td>Pond</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Pond</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Pond</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Possible water race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Pond</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>Pond</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stanley Reward Lode Workings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 a</td>
<td>Trench</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Dam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Trench</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Possible collapsed adit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Air shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>Water race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j</td>
<td>Possible open cut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l</td>
<td>Trench</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stanley Reward Water Supply System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 a</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Start of water pipeline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Pipeline valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Pipeline intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Water race - Southern bypass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Water race - northern end</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stanley Reward Occupation sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 a</td>
<td>East of Stanley River - refuse dump</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>East of Stanley River - shovel head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>West of Stanley River - possible hearth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>West of Stanley River - sheet iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>West of Stanley River - possible toilet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>West of Stanley River - refuse dump</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stanley Reward Transport In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 a</td>
<td>Bridge remains- east end</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Bridge remains - west end</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Foot bridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Track</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>News Creek Alluvial Workings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 a</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Mullock heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Mullock heap and races</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Livingstone Creek Lode Workings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7a</td>
<td>Exploratory tunnel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 - Historic heritage inventory list

Stanley Reward Alluvial Workings
- Historic Value: High [at local level]

Stanley Reward Lode Workings
- Historic Value: Moderate [at local level]

Stanley Reward Water Supply System
- Historic Value: High [at local level]

Stanley Reward Occupation sites
- Historic Value: High [at local level]

Stanley Reward Transport In
- Historic Value: Low [at local level]

News Creek Alluvial Workings
- Historic Value: Moderate [at local level]

Livingstone Creek Lode Workings
- Historic Value: Low [at local level]
The following summarises the key findings of the survey areas.

**Stanley Reward Alluvials**
The Stanley Reward alluvial workings are located on both sides of Livingstone Creek as it enters the Stanley River, and also on both sides of the Stanley River. The workings are accessible via Venture Minerals’ cut line leading to the RW6 site. The landscape is characterised by low, flat swampy land covered in predominantly tea tree, cutting grass and ferns. Alluvial mining has taken place on both the eastern and western sides of the Stanley River. A total of 13 features were located within these areas.

**Stanley Reward Lode Mining**
The Stanley Reward lode workings are located to the east of the Livingstone resource, accessible via Venture Minerals’ cut line leading off the PRW 7 and 8 sites.

The lode body exists in steep, heavily vegetated terrain. Running roughly north-west to south-east, the linear formation of the lode extends for some 100 m. On its eastern edge, the lode is bounded by a small creek, identified on the 1964 plan as the possible old alignment of Livingstone Creek. A total of 12 features were located within these areas.

**Stanley Reward Water Supply System**
The Stanley Reward Water Supply System is located to the east of the Stanley River and consists of both the iron water supply pipeline (or, more accurately, penstock) and the water race, which fed the pipeline. The pipeline terminates near the riverbank, where the topography is flat and sandy and covered in light tea tree cover. From its end point, the pipeline trends eastward, traversing approximately 100 m of low swampy land, before the topography sharply rises to the western flank of Mount Lindsay. The latter is characterised by open forests with comparatively little understorey growth. The pipeline alignment joins the water race at an elevation of some 340 m above sea level, again dominated by open forests. In total, approximately 750 m of water race was identified and followed as it occurs within the study area. Seven features related to the water supply system were recorded.

**Stanley Reward Occupation Sites**
Two areas of former occupation were investigated. The key settlement area was located on an elevated position on the eastern bank of the Stanley River, and north of the termination of the pipeline. The main settlement area is thought to have been located above these excavated areas.

The second area of former occupation was located to the west of the Stanley River. The site was located on a low, south facing slope covered in dense Myrtle forest, but with a comparatively open understorey. The ground surface had a dense layer of humus. A total of six features/items were recorded within both sites of former occupation.

**Stanley Reward Transport Infrastructure Sites**
These sites consisted of the bridges and track formations on the western side of the Stanley River. The Stanley River Bridge site was accessed from the recently cleared and excavated trench area leading to Venture Minerals’ SRD005 site. A total of four sites were located in these areas.

**News Creek Alluvial Sites**
These sites were accessed from the road network established at Mount Lindsay by Venture Minerals. A total of four sites were located in these areas.

**Livingstone Creek Sites**
Two key areas were investigated along Livingstone Creek, firstly the lode formation near the northern end of the study area, and secondly the locations of a series of alluvial workings, south of the lode.
The Austral report concludes that the study area contains features of historic heritage significance, and that this significance is manifest at the local level. It should be noted that the majority of historic heritage sites identified, ie the Stanley Reward sites, will not be impacted as the Livingstone project works will not disturb these areas.

2.7 Key issues

As described above, a substantial amount of site investigations have already been undertaken. Conceptual mine planning has also been undertaken.

These investigations and planning activities have identified the following as being key project issues. As with all relevant issues, these will be addressed in the DPEMP.

2.7.1 Environmental issues

The proposed mine has only a low potential to impact on matters of ecological significance.

The mine lease does not contain threatened vegetation communities or plant species.

The only matters of potential conservation significance are the presence of Tasmanian devils and spotted-tailed quolls but for both these species only 1 or 2 animals might be affected by vegetation clearance and even these low impacts will be mitigated by the creation of denning opportunities from cleared vegetation. The implementation of monitoring and also roadkill mitigation measures will further mitigate potential impacts.

The key environmental issues are the management of surface, pit and process water. This will be described in detail in the DPEMP.

2.7.2 Health issues

There are no significant public health issues associated with the proposed mine.

Health issues are confined to the normal occupational health and safety issues relevant to an operating mine and minerals processing facility.

2.7.3 Economic and social issues

The proposed mine is located in a region where mining is the principal economic activity and the project will be consistent with the existing social fabric of the region.

The mine will provide a social and economic stimulus for the township of Tullah, which is likely to be the primary residential location of the mine workers. Venture Minerals is considering establishing a worker accommodation facility in Tullah to provide residential facilities for its staff.

The mine will be located in an area subjected to more than a century of previous mining and exploration activities and will therefore be consistent with established land use.

Elements of the mine are likely to be visible from the Pieman Road but this visibility will not be incongruent with the character of the area, which already has substantial mining activity. A viewshed analysis will be provided in the DPEMP.
The mine lies within a broad region that has been nominated for inclusion on the National Heritage List, primarily due to claimed wilderness values. This nomination is currently the subject of an assessment by the Australian Heritage Council. Venture Minerals has provided detailed submissions about the site and its past mining activities to the Council to support an excision of the proposed mining lease and its surrounding areas from any listing, should any such listing be recommended.

2.8 Survey and studies

Surveys and studies undertaken to date have been identified throughout this document, and include:

- North Barker Ecosystem Services (February 2012) *Livingstone Mine Proposal, Botanical Survey and Fauna Habitat Assessment*.
- CHMA (July 2011) *Stanley River Mining Lease Area, North-West Tasmania, Aboriginal Cultural Heritage Assessment Final Report*.
- Austral Tasmania (July 2011) *Stanley River, Tullah, Historic Heritage Desktop Assessment*.
- Austral Tasmania (October 2011) *Stanley River, Tullah, Historic Heritage Assessment*.

Additional studies and investigations to come include:

- A continuation of the surface and ground water monitoring
- The implementation of a baseline roadkill monitoring program
- Further determination of the characteristics of any potential acid generating materials
- Further development of the mine plan.

The findings and outcomes of the studies and investigations will be described in the DPEMP.

2.9 Proposed timetable

A DPEMP will be submitted in late 2012. Construction work is planned to be commenced in late 2014 with production scheduled to commence in the first quarter of 2015.