GOLD MINE IN C CLASS NATURE RESERVE 18584, WESTONIA.

(RUTHERFORD'S REWARD MINE)

CONSULTATIVE ENVIRONMENTAL REVIEW.

Prepared by

Hart, Simpson and Associates Pty Ltd

for

Rutherford Resources Pty Ltd

July 1993

INVITATION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The Consultative Environmental Review (CER) describes a proposal to mine gold in a C Class Nature Reserve near Westonia. In accordance with the Environmental Protection Act, a CER has been prepared which describes this proposal, and its likely effects on the environment. This CER is available for a public review period of 4 weeks from 12 July 1993.

Following receipt of comments from government agencies and the public, the EPA will prepare an assessment report with recommendations to the government, taking into account issues raised in public submissions.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions may be fully or partially utilised in compiling a summary of the issues raised or, where complex or technical issues are raised, a confidential copy of the submission (or part thereof) may be sent to the proponent. The summary of issues raised is normally included in the EPA's assessment report. Submittors would not be identified to the proponent without the submittor's permission.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group or other groups interested in making a submission on similar issues. Joint submissions may help reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues or the specific proposals discussed in this report. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposals in this report:

- clearly state your point of view,
- indicate the source of your information or argument if this is possible,
- suggest recommendations, safeguards or alternatives.

Points to keep in mind.

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues are clear. A summary of your submission is helpful,
- refer each point to the appropriate section, chapter or recommendation in the report,
- if you discuss different sections of this report, keep them distinct and separate, so there is no confusion as to which section you are considering,
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name,
- address, and
- date.

The closing date for submissions is 9 August 1993.

Submissions should be addressed to:

The Environmental Protection Authority
Westralia Square
141 St Georges Tce
Perth WA 6000

Attn: Ms J. Aberdeen

CONTENTS.

1. SUMMARY.

Rutherford Resources Pty Ltd proposes to develop a small gold deposit in a belt of greenstone near Westonia, between Merredin and Southern Cross, in an area with a history of gold mining. The site would occupy 6ha in a C Class Nature Reserve of 577ha, and the mining would take about three years. Government policy permits mining in this Nature Reserve subject to normal environmental assessment procedures. The Environmental Protection Authority has set the level of assessment at a Consultative Environmental Review.

There are no rare flora or fauna species which would be significantly affected by the operation, but the Nature Reserve is in an area which has been largely cleared for agriculture and where all conservation areas have a high value. The major environmental issues are identified as minimising the disturbance to the Nature Reserve and rehabilitating the site so that the land can be returned to the Nature Reserve with no long term loss of conservation values.

The mine has been designed to disturb the smallest possible area of the Nature Reserve by carrying out the mining and treatment within the mine pit, and as many other facilities as possible will be located outside the Nature Reserve. Rehabilitation to the original native vegetation is an integral part of the operation. This will be based on seed collecting, conserving the vegetation and topsoil, and restoring of the topography. Rehabilitation will have to meet pre-determined success criteria.

The operation will be managed to prevent the introduction of weeds or diseases to the Nature Reserve.

The mining and treatment will be by conventional heap leaching with cyanide, and extraction in carbon columns. The ground water is salty and there are no users of the ground water resource. A mixture of salty ground water and fresh water from farm dams will be used in the treatment. After the mining and treatment operations, the process water will be treated to break down the cyanide, and the water will be flushed down to the ground water with fresh water.

The area is sparsely populated, with the nearest residence 3km away, and there will be only small amounts of trucking to supply fuel and some materials. There will be no significant social impact.

2. INTRODUCTION.

Rutherford Resources Pty Ltd proposes to mine a small gold deposit near Westonia, between Merredin and Southern Cross, in an area with a history of gold mining. The site is in a C Class Nature Reserve and the Environmental Protection Authority has set the level of assessment at a Consultative Environmental Review. In accordance with the guidelines (Appendix 1) this document describes the site and the proposed project, assesses the possible environmental impacts, and describes how the project will be managed to eliminate or control unacceptable impacts. Public input was sought during this process from interested parties, and the public input is also discussed. This document has been designed to provide information to the public and decision-making authorities so that appropriate decisions can be made.

The proponent of the project is Rutherford Resources Pty Ltd of 4 MacDonald St Merredin 6415. The Principals of Rutherford Resources live in Merredin and Bruce Rock.

The proposed mine would be very small and shallow, with a proven ore reserve of 230,000 tonnes of lateritic ore, and the mining would take about three years. The mine would occupy about 6ha in C Class Nature Reserve 18584 in the Shire of Yilgarn, approximately 8km south-east of Westonia (Figure 1, next page). The site is roughly half way between Merredin and Southern Cross in the eastern Wheatbelt. Mining has taken place around Westonia for many decades, and there are old diggings to the south-east of the present project.

3. THE NEED FOR THE PROJECT.

The proponent believes that sufficient work has been carried out to show that the proposed mine is profitable despite its small size, and that the project can accommodate the environmental requirements. The project will have the benefit of generating income to the proponent as well as the State and Commonwealth generally, but more particularly it will bring employment and income locally to an area which has been suffering a serious economic decline.

Under State Government policy, exploration and mining is permitted in C Class Nature Reserves and there is no policy barrier to development of the mine as long as it is found to be environmentally acceptable.

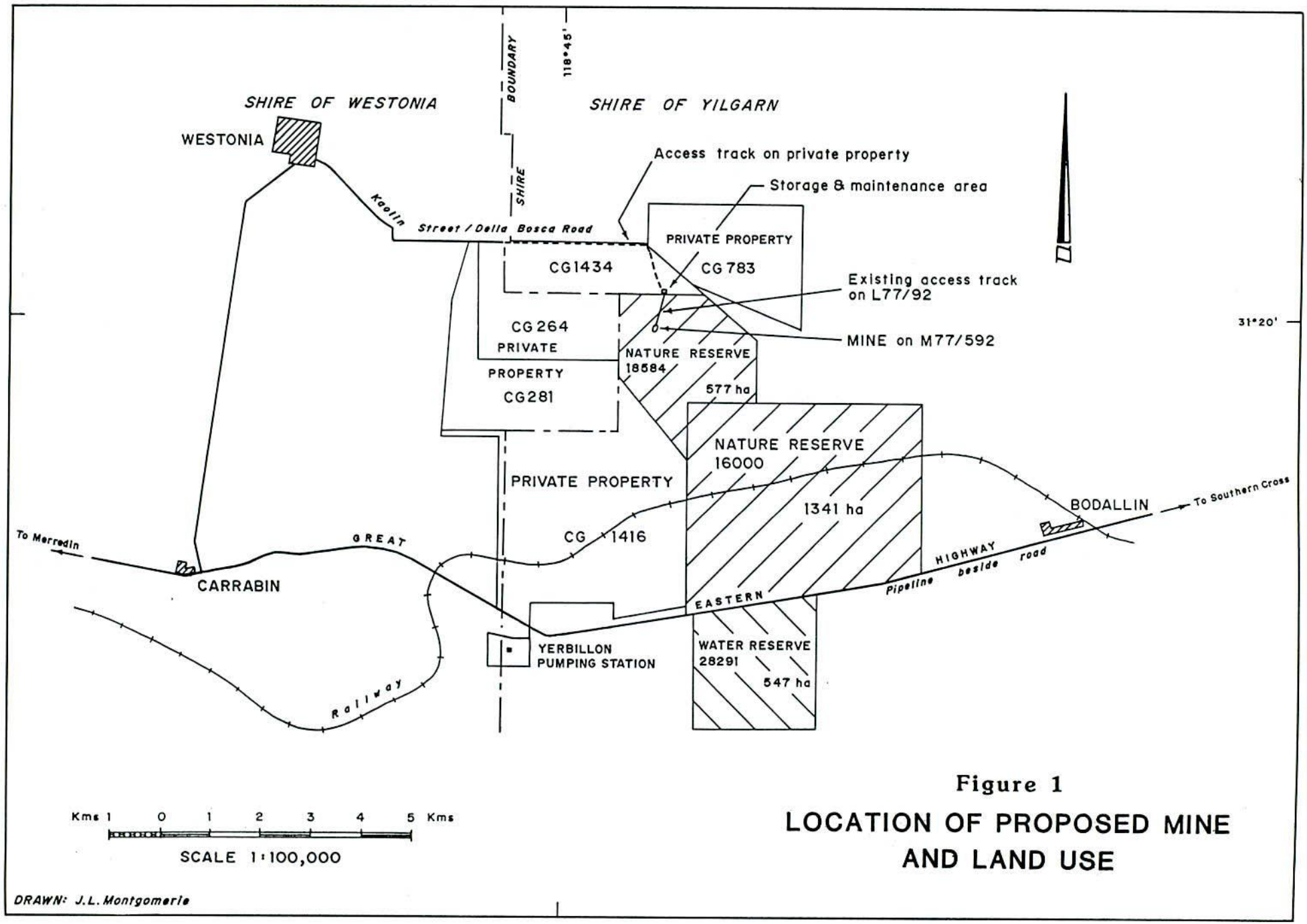


Figure 1

LOCATION OF PROPOSED MINE AND LAND USE

4. THE EXISTING ENVIRONMENT.

4.1 LOCATION AND LAND USE.

The proposed mine is on Mining Lease M77/592 (applied for) with access through Miscellaneous Licence L77/92 (applied for) from the north, in the Shire of Yilgarn. The site is on C Class Nature Reserve 18584 of 577ha. The actual mine would occupy approximately 6ha. Access is from the adjacent Shire of Westonia along a minor road, and through the Shire of Yilgarn across private property where there is an adjacent road reserve but where no road has been developed (Figure 1).

Regionally most of the land has been developed for wheat and sheep farming with occasional areas of native vegetation in reserves. Reserve 18584 is continuous with Nature Reserve 16000 of 1341ha and Reserve 28291 of 547ha for Water. Reserve 18484 was a temporary reserve before being gazetted for Timber in 1924 to supply timber for the steam engines at the nearby Yerbillon pumping station on the Perth to Kalgoorlie pipeline. By 1925 it had been cleared of useful timber and was left to regenerate, although seed was apparently collected from the reserve at times. In 1979 it was made a C Class Nature Reserve for the Conservation of Flora and Fauna. The adjacent Nature Reserve 16000 has a similar history. In 1924 its purpose was changed from Common to Public Utility. Grazing leases were held over parts of Reserve 16000 for many years until they were cancelled in 1978, and in 1979 the purpose of the reserve was changed to Conservation of Flora and Fauna.

The proposed mine and the immediate surrounding area were previously opened by bulldozing grid lines and were drilled for gold exploration by another party, and these holes remain open. Exploration drilling was also carried out for the present project over a smaller area, but the holes have been capped in accordance with present practice.

The surrounding area is sparsely inhabited. The residence nearest to the mine is approximately 3km to the north-west. Westonia is today a small town, but it was once a major gold mining centre based on the Edna May mine.

4.2 SOILS AND TOPOGRAPHY.

Geologically, the site is on one of the "greenstone" belts which traverse the landscape NNW-SSE and represent the original Archaean sedimentary and igneous rocks where they have not been modified by intrusion of later granite. The greenstone belt through Westonia is small when compared with the huge lines which run through the "Goldfields" further east, but is otherwise the same.

The soils and topography are closely related. Regionally, the typical pattern is of flat sandplains on the more elevated areas and loamy or clayey soils in the valleys. The valleys are very wide and low, and the total relief is usually very small and may not be apparent on the ground. In the typical greenstone belt there is little of the upland lateritisation and sandplain.

Granite occurs throughout the adjacent areas as intrusions above the surface, but there are no large expressions of this on the Nature Reserve and none on the mining area. The nearest large granite exposure is two kilometres to the south-west on private property.

On the site the soils and topography reflect this regional pattern almost exactly. The entrance track starts on more elevated ground through a sandplain with coarse yellow or pale brown sand with some surface gravel, and slowly descends to the mining area on red-brown loamy or clayey soil sometimes with surface gravel or other stones. There is a mosaic of these two soils where they meet, and some mixtures which are earthy.

Within the orebody there is a red pisolitic gravel below the surface, with little or no topsoil (0-100mm) above this gravel. Below the orebody the soil changes abruptly to a more clayey layer.

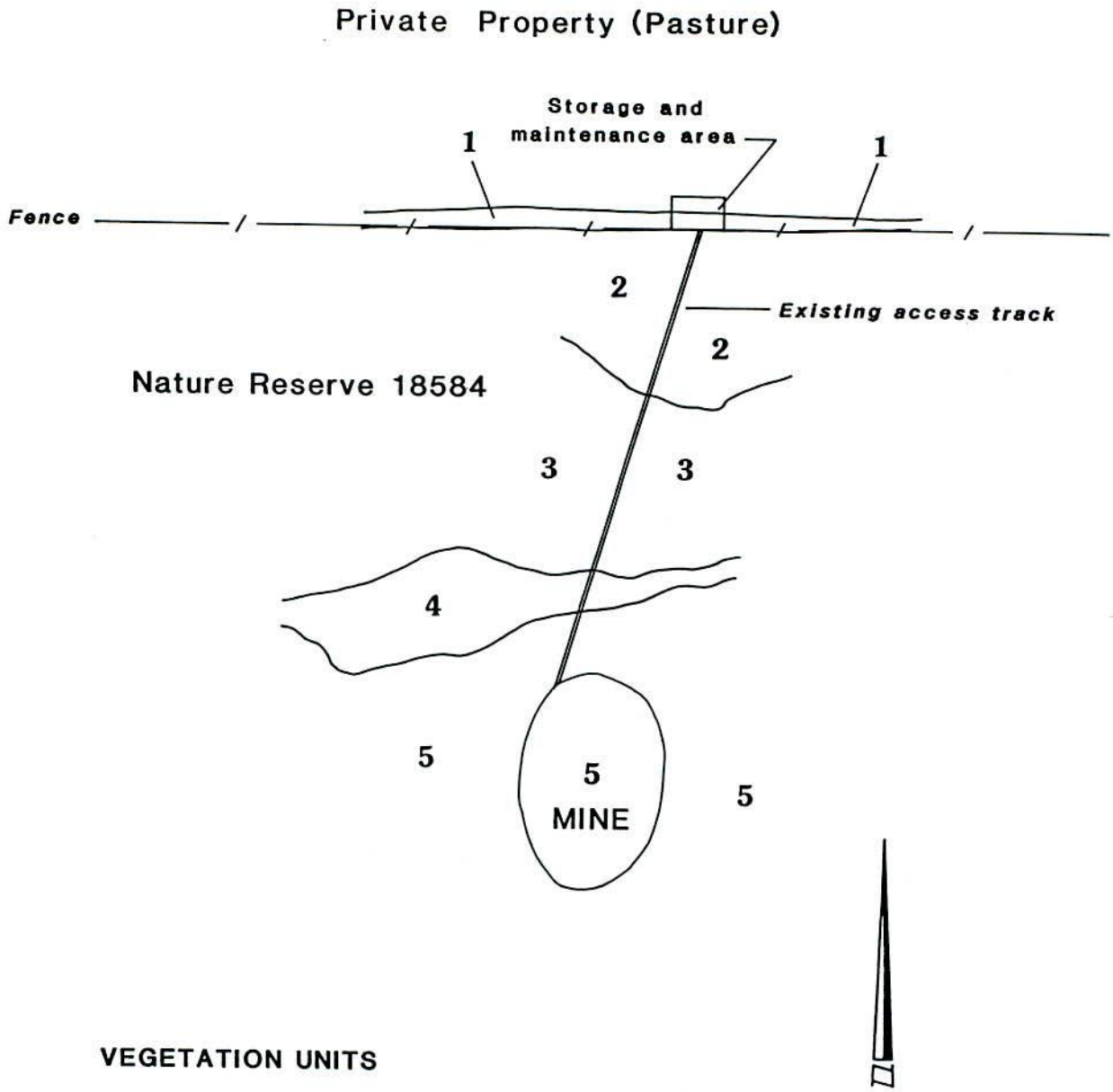
4.3 VEGETATION AND FLORA.

The vegetation of the access route, mine and surrounding area was examined in detail by describing typical sites, and the vegetation was divided into natural units. A more cursory study was made of adjoining areas to place the mine site vegetation in a local context. The flora of the site was studied by collecting plant species along the access route and in the mine area. Most attention was given to the area which will be cleared, where the site was searched thoroughly and every species was collected. The survey was carried out in April 1993 under dry conditions and the vegetation was in poor condition at the time, with few species flowering. All species encountered are listed below. Some species could not be identified with complete confidence and these are indicated by a question mark.

The vegetation consists of five units (Figure 2, next page):

1. Adjacent to the Nature Reserve on private property there is a narrow remnant of mallees of Eucalyptus burracoppinensis and smaller numbers of E. leptopoda over a thicket with the common species being Allocasuarina corniculata, Baeckea aff. behrii, Melaleuca conothamnoides and Hakea erecta, and with smaller numbers of Baeckea muricata, ?Needhamiella pumilio, Persoonia diadena, Hakea francisiana, Verticordia sp., Acacia resinomarginea, Leptomeria aff. preissiana and Grevillea paradoxa. This unit occurs on sandplain with no gravel. Regionally, this unit has been extensively cleared for agriculture because it is regarded as an indicator of prime farming land.

2. Along the access route within the Nature Reserve there are very sparse mallees of Eucalyptus leptopoda and E. sheathiana over a thicket with the common species being Allocasuarina corniculata, Acacia resinomarginea, Baeckea aff. behrii, Allocasuarina acutivalvis and Phebalium ?tuberculosum, and with smaller numbers of Leptomeria aff. preissiana, Hibbertia exasperata, Grevillea paradoxa, Melaleuca uncinata (several forms), Persoonia sp., Melaleuca conothamnoides, ?Needhamiella pumilio, Persoonia diadena, Acacia signata, Hakea francisiana, Acacia aff. jamesii, Melaleuca lateriflora and Acacia hemiteles. This unit occurs on sandplain with some gravel.



VEGETATION UNITS

1 Mallees over sandplain thicket

2 Sandplain thicket

3 Woodland/thicket mosaic

4 Drainage line

5 Woodland

0 100 200 300 400 500m

Scale 1:10,000

Figure 2

VEGETATION

Drawn: J.L. Montgomerie

3. Between the thicket and the woodlands there is a transition zone which is a mosaic of thicket and woodlands over scattered shrubs on sand and loams respectively. The common species in the thickets were Acacia resinomarginea and Allocasuarina acutivalvis, with smaller numbers of Santalum acuminatum, Calothamnus ?aridus and Hibbertia exasperata. The woodlands included trees of Gimlet (Eucalyptus salubris), Eucalyptus transcontinentalis and E. capillosa ssp. capillosa. The only common shrub was Daviesia nematophylla, with smaller numbers of Dodonaea bursariifolia, Westringia cephalantha, Exocarpos aphyllus, Templetonia egena, Grevillea acuaria, Acacia acoma, A. resinomarginea, A. hemiteles, Grevillea paradoxa, Phebalium ?tuberculosum and ?Needhamiella pumilio.

4. In a minor drainage line which crosses the access track there is a patch of denser vegetation of small trees of Eucalyptus loxophleba ssp. lissophloia over tall shrubs particularly Acacia resinomarginea and Allocasuarina acutivalvis, with smaller numbers of Hakea francisiana, Olearia muelleri, Melaleuca eleuterostachya, M. laxiflora, an unidentified Melaleuca, Dodonaea viscosa ssp. angustissima and Acacia erinacea.

5. The mine site itself is in woodland dominated by Salmon Gum (Eucalyptus salmonophloia), Red Morrel (E. longicornis) and Gimlet (Eucalyptus salubris), with a smaller number of E. transcontinentalis. There is a variable shrub stratum with no dominant species. The most common species recorded were Acacia resinomarginea, A. erinacea, A. acoma, A. costata, A. hemiteles, Allocasuarina acutivalvis, A. corniculata, Exocarpos aphyllus, Templetonia egena, Daviesia nematophylla, Melaleuca sp., Grevillea acuaria, Dodonaea bursariifolia, D. stenozyga, Olearia muelleri and Westringia cephalantha, with the parasitic Amyema miraculosum ssp. miraculosum common on the trees. Other species recorded less commonly were Alyxia buxifolia, Dianella revoluta, Santalum acuminatum, S. aff. acuminatum, Scaevola spinescens, Phebalium ?tuberculosum, Santalum sp., Eremophila spp., E. ionantha, Cryptandra sp., ?Pultenaea neurocalyx, Glischrocaryon aureum, Rhagodia preissii, Senna artemisioides ssp. filifolia and Melaleuca sheathiana. In one small naturally open area where it is proposed to build the camp site there were several species of salt bushes, including Maireana tomentosa and Atriplex semibaccata. The herbaceous stratum was limited to scattered dead herbs, grasses and daisies, with the succulent herb Zygophyllum glaucum the only species identified. The woodlands occur on loamy soils, sometimes with gravel or more rarely with quartz stones.

FLORA.

The list of species given above is not a complete list of the flora because the annual flora of herbs, grasses and daisies was not present, but most of the perennial flora would have been collected. There are no Declared Rare annual species known to be present in the area.

Rare plant species which might be present were identified from the Rare Flora database held by the Department of Conservation and Land Management and other records. The only Declared Rare Flora species known in the area are Eremophila resinosa (a small shrub found in sandplains which could occur near the access track but not in the mining area), E. viscida (a tall shrub which could occur on the mining area), E. virens (a tall shrub found only around granite rocks and not expected to occur in the area), Daviesia oxylobium MS (a small shrub found on sand and laterite which could occur near the access track but not in the mining area) and Eucalyptus crucis ssp. crucis (a small tree found on or around granite rocks and not expected to occur in the area). Particular searches were made for these species around the mining area. No Declared Rare Flora species were found, and none of the unidentified specimens collected were similar to any of these species. Similarly, no Priority species were found. Priority species are species which are apparently rare, restricted or poorly known, to some degree, but do not have the status of Declared Rare Flora.

No species of weeds were found, but a few herb and grass species are probably present in winter. The native perennial herbaceous species Glischrocaryon aureum which is most common on disturbed ground was found in a few sites around old drill holes.

The woodland consists largely of young trees which have regenerated since the land was cut over for timber or of coppiced stems from trees which were felled. Small numbers of larger trees are present, and these had presumably been rejected in the original timber felling. Plates 1 and 2 on the next page show a typical section of the mining area and of the coppicing of stems which were apparently cut before 1925.

CONDITION.

Despite the previous timber cutting, the vegetation is intact native vegetation in good condition. Weeds appeared to be a minor component of the flora. The timber cutting probably had little impact on the vegetation apart from reducing the size of the trees.

Plate 1. A typical view of the mining area, with occasional large trees in amongst the regenerating smaller trees.

Plate 2. A typical patch of trees regenerating from cut stems.

The adjacent Nature Reserve 16000 was subjected to grazing and contains a noticeable grass weed component in the flora, and in addition poison plants would have been removed and the most palatable species such as the salt bushes may well have been reduced in numbers. Salt bushes were a very small part of the flora collected on the proposed mining site.

The site is outside the area normally considered as at risk from dieback due to the Phytophthora fungi, although the Department of Conservation and Land Management maintains a conservative approach to this and other possible soil borne diseases by maintaining hygiene controls on operations which are likely to spread soil diseases. Hygiene controls have been applied throughout the exploration phase. These controls are also useful in limiting the spread of weeds.

LOCAL AND REGIONAL CONTEXT.

A short examination of the adjacent areas of Reserve 18584 and Reserve 16000 showed that the vegetation units described here are typical of the area, but other units also occur. The total area of woodland on greenstone within these reserves is not known but probably exceeds 1,000ha. Woodlands on greenstone also occur in the Westonia common, north of Westonia, but there they have been disturbed by grazing, exploration and mining over many years.

The vegetation and flora described here is typical of that seen on greenstone belts regionally. Beard (1972) mapped the vegetation of the region. He mapped the Westonia greenstone belt as part of the Yilgarn System, which includes the large area through Southern Cross and two outliers including the Westonia greenstone. Botanically the local area is part of the Avon Botanical District but is very similar to the adjacent Coolgardie District to the east which includes most of the Yilgarn System. Similarly most of the plant species recorded are common and widespread. This is also reflected in the relative absence of rare species. Little information is available on the flora locally because there have been few surveys, but it is unlikely that any species are restricted to these small areas of the common soils and landforms seen here. Greenstone soils in general are not regarded as likely to contain many rare or unusual species.

4.4 FAUNA.

No useful discussion of the invertebrate fauna can be given. A detailed vertebrate fauna survey was not carried out on the site because this was not justified by the scale of the project. The habitats present were described from the soils, vegetation, flora, leaf litter and other features which determine animal habitats, and a list of the vertebrate species which could occur on the site was drawn up from records held by the W.A. Museum, published sources and general information on the species and their distribution. This list is given in Appendix 2.

The list in Appendix 2 was drawn up conservatively so that all species which might be present could be considered. From this list, the species of conservation interest which might be present are:

- The Chuditch, which is gazetted as rare or likely to become extinct under the Wildlife Act. This species has declined greatly over most of its range and is now probably restricted to the wetter part of the south-west. There have been no local records for at least 20 years and it is likely that it is locally extinct or extremely rare.

- The Woma, a python, which is not gazetted as rare or likely to become extinct under the Wildlife Act but as "otherwise in need of special protection". This species has declined greatly in the south-west, although there is a separate population in the north. The last local record was from Burracoppin in 1973 and this species is now very rare or locally extinct. It would occur primarily on the sandplain and not the woodland.

- The Carpet Python, which is also gazetted as "otherwise in need of special protection". This species is widespread in the south west. It can be found in hollow logs, rock holes and burrows, and is sometimes found around human settlements (Wilson and Knowles 1988). It has traditionally been regarded as a welcome animal because it eats mice. It has declined due to loss of habitat, predation and deliberate killing in error for venomous snakes. It probably survives locally but would be rare or uncommon. There are no recent local specimens in the W.A. Museum.

- The Peregrine Falcon, which is also gazetted as "otherwise in need of special protection". This species occurs Australia-wide, but is not common anywhere. Its decline in numbers is attributed to birth defects and egg-shell thinning due to pesticide ingestion, falconry, illegal trade, and destruction as a pest in some areas (Garnett 1992, Kennedy 1990). The Australian subspecies is affected by pesticides in relatively small areas subject to intensive agriculture and Garnett (1992a) considers its status as secure in Western Australia. This species would be present as an occasional visitor, mainly hunting other birds.

- Carnaby's Black-Cockatoo, which is also gazetted as "otherwise in need of special protection". This species occurs throughout the drier part of the south-west but has declined in population due to extensive land clearing in its range. It is dependent on the combination of heath and other native vegetation to provide food and woodland with large trees to provide nesting hollows (Saunders et al. 1985). It breeds in spring, and abandons the nest hollows by about mid-summer.

Introduced species are restricted to the common mammals (mouse, rabbit, fox and cat) which are common and widespread throughout the South-West.

An extensive survey of the fauna of the Wheatbelt (see Kitchener 1976) found that in general the mammal fauna has declined greatly since European settlement with many extinctions, while the reptiles and birds have fared better. The area under native vegetation is now very small, and many species are restricted to the small and isolated remnants of native vegetation. All species have declined due to the loss of habitat but the mammals have also been severely affected by changes to burning patterns and the introduction of predators. These trends are continuing and the Nature Reserve considered here must be regarded as an important part of the nature conservation estate available to the native fauna.

4.5 HYDROLOGY.

A detailed hydrological study of the site has not been carried out because it is not required for either mine planning or assessment of the site.

The exploration drill holes show that the water table is approximately 47m below ground level. Water samples taken from just below the water table show that the water has a pH of 5.9 (on the acid side but close to neutral) and is salty with 40,000 ppm total dissolved solids (approximately 15% saltier than sea water). The salt is mainly sodium chloride. This water is too salty for any agricultural use and there are no local users of the ground water resource.

There is no developed surface drainage in the mining area itself because of the low relief, but there is a small drainage line to the north which flows east to west (Figure 2). Drainage over the relatively impervious loamy soils would be by sheet flow after heavy rain.

4.6 HERITAGE VALUES.

There are no known European historical features or Aboriginal sites known to the W.A. Museum in the area. No specific survey has been carried out. If any Aboriginal sites are discovered the mining will be carried out within the provisions of the Aboriginal Heritage Act.

4.7 CONSERVATION VALUES.

The proposed mine area is in a C Class Nature Reserve in an area which has been largely cleared for agriculture. It is now generally accepted that excessive clearing has taken place and that this is damaging the land and its productivity. There is now considerable interest in increasing the area of land with trees or native vegetation.

The proposed mine area has few specific high conservation values. There are no Declared Rare Flora species present. The highest specific value identified is habitat for Carnaby's Black-Cockatoo. The other rare fauna species listed are either doubtfully present or the proposed mine would have no significant impact on the total distribution and status of these species.

Despite the absence of high specific conservation values, the land itself has a high conservation value because it is in a Nature Reserve in an area which has been largely cleared and there are limited opportunities to increase the conservation estate. While the proposed mining will inevitably disturb a small area, it should not be allowed to reduce the conservation value of the land in the long term.

5. THE PROPOSAL.

5.1 GEOLOGY.

The orebody is the lateritic expression of a narrow quartz and gold vein which strikes east-west and dips about 70^{o} north. This structure has not been fully delineated, but appears to be barren of economic gold values between the surface lateritic layer and 25m depth. The surface contact of this structure is at about 17550 N (Figure 3, next page). There is a total of about 230,000 tonnes of ore.

The orebody is approximately an oval 300m north-south and 200m east-west with a maximum depth of 6m in the centre and tapering to 2m at the periphery. The orebody forms a slight hill with the highest elevation at RL 381m in the north-east and the lowest at RL 376m in the south. The total difference in natural elevation within the mining area is 5m. The ore is a dark red pisolite gravel with pisolites and iron stone visible on the surface. Below the ore there is a clayey limonite which has a sharp boundary with the ore.

5.2 MINING AND PROCESSING.

The ore is amenable to vat leach treatment, and the area of clearing can be kept to a minimum by carrying out the leaching within the mine pit in two phases, with the second pile constructed on top of the first within the mine pit. This eliminates the need for a separate heap leach and associated ponds for the process waters which would disturb much greater areas.

The mining will be carried out over two years, with about 134,000 tonnes mined in the first year and 96,000 tonnes in the second year.

Seed of as many species as possible with long-lived seed will be collected from the site before clearing takes place. The area will be cleared with a large bulldozer. Seed can then be collected from the felled trees. The vegetation will be pushed into a windrow around the periphery and the topsoil of about 100mm will also be pushed to the periphery and partially onto the vegetation to protect it from fire and to minimise the disturbed area. This ring of vegetation and topsoil will be about 11m wide and 2m high, and cover 0.86ha of the mine area. It will also form a security barrier around the site. The only gap in this ring will be the access track where existing drill lines enter the site in the north-eastern corner.

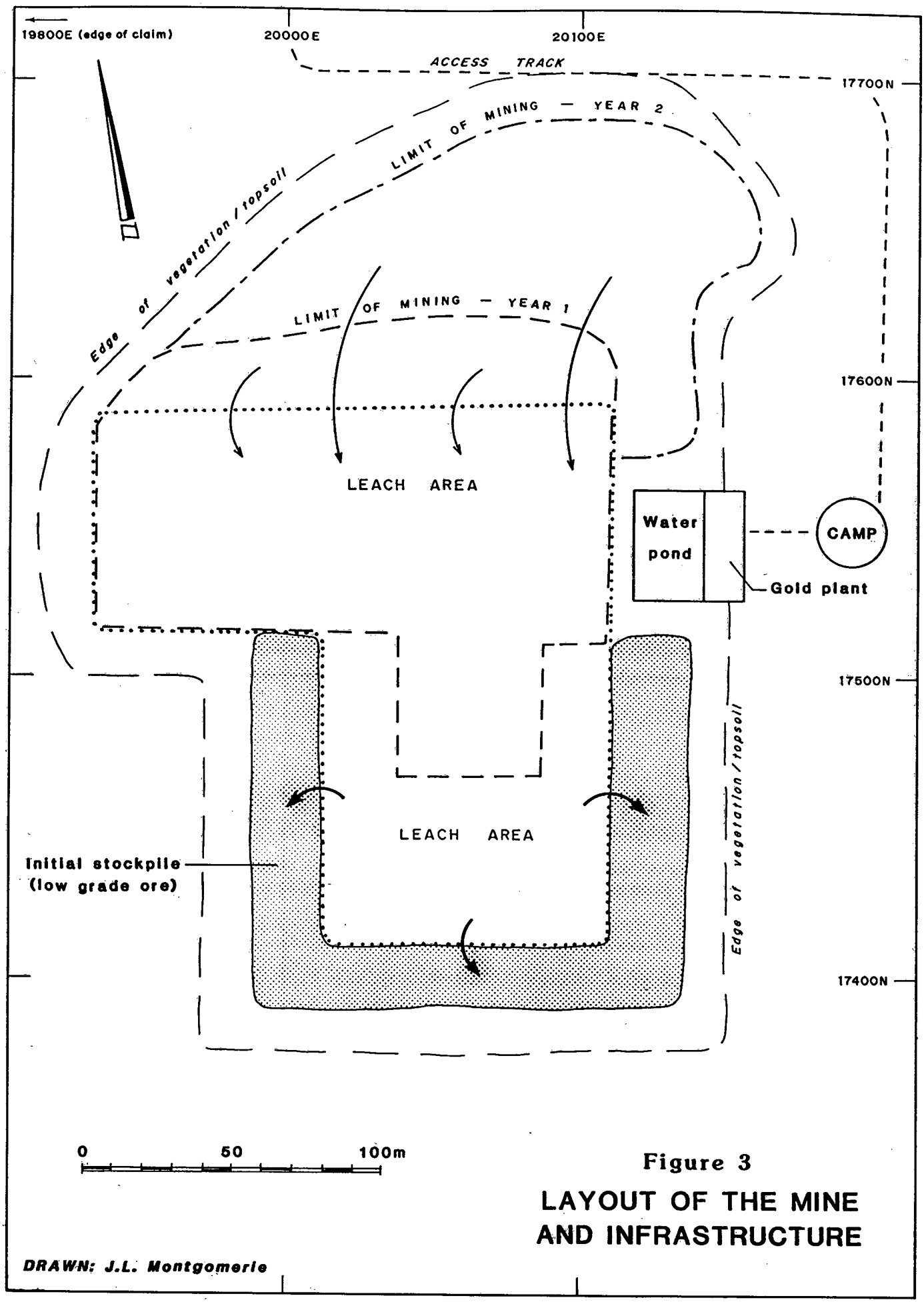


Figure 3

LAYOUT OF THE MINE AND INFRASTRUCTURE

DRAWN: J.L. Montgomerie

After clearing the vegetation and topsoil, the bulldozer will create an initial hole by pushing up a horseshoe-shaped pile of low grade ore at the southern end (Figure 3). There will be approximately 36,000 tonnes of this ore in a pile 4m high, 25m wide and 280m long. Most of this pile will be treated in the second year.

There is no overburden, and below the topsoil the orebody is apparently homogeneous.

The initial hole will be approximately 100m east-west and 70m north-south, and 2m deep. It will be lined with a plastic sheet to form the vat for leaching. The plastic will extend 1m up the face of the ore pile, and this 1m cannot be mined.

The bulldozer will also construct a small dam adjacent to the eastern side of the orebody to hold 2,000 cubic metres of water. The dam will be lined and there will be a lined spillway on the western side so that any excess water will flow into the vat leach. A pad will be constructed on the dam wall to hold the processing plant. This pad will be 5m east-west and 25m north-south, and will have an impervious sheet with a slope to the west so that any spills or leaks of process water will flow into the vat or the dam.

The bulldozer will then leave the site and a large front end loader will be brought in to do the actual mining and heap construction.

A face of ore will be established north of the plastic sheet and the front end loader will dig from this face onto the plastic to a height of 4.5m above the plastic. The face will vary between 2 and 6m in height. As the mining proceeds additional panels of plastic sheet will be laid, and perforated drain coils and geotextile fabric will be laid under the ore to facilitate the collecting of the process water. The heap and mine face will progress from south to north, with an initial distance between them of 60m but this will decrease over time due to swelling of the excavated ore and the increased mine face height. Two sumps will be installed in the bottom of the heap during construction to reclaim the process water from the bottom of the heap. The vat will be terminated and the plastic sheet will be brought up to the same level as the southern end about 175m north of the original southern wall, at RL 377. The top of the heap will be hand levelled ready for the leaching.

The front end loader will then leave the site and not return until the second phase of the mining a year later. From the start of clearing to this stage will have taken about four months.

The gold will be recovered by the conventional leaching method which is used throughout Western Australia. Dilute cyanide solution is passed through the ore, and the gold is leached out. Normally the heap is gravity drained through a side wall into a dam and the heap is flooded with solution. In the present case sumps in the bottom of the vat will be used and the leachate will be pumped up, and the solution will be applied to the heap by drip emitters rather than sprinklers. This procedure is designed to eliminate the need for separate ponds, and to minimise the use of water. This also removes the problem of animals being attracted to the ponds and sprinklers.

The drip emitters will be placed at one in each square metre, and will deliver $40m^3$/hr with an evaporation loss of 3% or $1.2m^3$/hr. Conventional sprinklers are efficient in delivering the solution but have an evaporation rate of 10%. The use of drip emitters was developed in the U.S.A. about four years ago to overcome the problem of ice formation, but they have been found to be desirable because they reduce the evaporation rate, reduce the loss of cyanide by light and oxygen contact, reduce surface compaction due to droplet impact, and reduce ponding due to leaks or jammed sprinklers. They can also be repaired or replaced while the system is operating, and the flow rate can be easily varied at the pump without changing the coverage.

The cyanide will be transported, stored and used in accordance with well established safety regulations and procedures. The cyanide is brought to the site as a dry material in drums. The storage area will be constructed on the north-east corner of the second year mining area, on high ground adjacent to the access road. The cyanide will be mixed with water in the processing plant to produce a concentrate, and added to the leaching solution by an injector pump and water meters to produce the final dilution. There will be no open ponds or spray of cyanide solution at any time. Cyanide will be used at about 250 grammes per tonne of ore, which will amount to about 30 tonnes in the first year and 22 tonnes in the second year. This is a small amount when compared with the large quantities used in the gold industry generally.

The process water will be made slightly more alkaline with caustic soda (sodium hydroxide) to reduce the consumption of the more expensive cyanide. The use of the hydroxide will be about 30 grammes per tonne of water, or a total of about 0.5 tonne per year, which is a small amount. The caustic soda is supplied dry in drums and would be simply diluted directly into the water pond. The caustic soda would be stored near the cyanide, as they do not react together. There are established procedures for transporting and handling this material.

The gold-bearing solution will be pumped from the sumps below the heap to the extraction plant of carbon columns placed next to the dam. After the gold is absorbed onto the columns the solution is re-used by making up the total volume from the dam to allow for evaporation and adding further cyanide to make up for the inevitable losses in the leaching and extraction.

Caustic soda is also used in the gold stripping process, but the amounts are less than used in the water treatment.

The processing plant will consist of three half tonne carbon columns, plumbing, a pump, and a trailer mounted stripping plant. The cyanide injection system would be adjacent to the plant.

The bottom of the vat will be at RL 372 or lower and the maximum working level of the solution will be at RL 375. The top of the vat wall will be at RL 377, allowing for no loss of solution because of flooding even in an exceptional rainfall event. There is no possibility of surface flooding because of the topsoil bund around the mine.

The gold will be extracted on site by conventional electrolytic deposition onto steel wool.

The second year of mining will be carried out by the front end loader. The ore will simply be heaped on top of the first year's ore. The second year of mining will take about two months, and no further vat construction or clearing will be required. Treatment and recovery of the gold is the same as in the first year. The flat top of the final pile will be between 6 and 2m above the original sloping surface.

In total the operation will take about three years.

5.3 INFRASTRUCTURE.

ACCESS.

Access to the site will be along Kaolin St and Della Bosca Rd from Westonia to the boundary of the Shires of Westonia and Yilgarn, and then across private property in the Shire of Yilgarn where there is no developed road. A small area immediately outside the Nature Reserve will be leased from the land owner and will be used for the facilities which do not have to be in the Nature Reserve. The proponent has come to an agreement with the land owner for the use of the access and the small area for facilities. A new gate will be constructed into the Nature Reserve and this will give access to an existing track which runs directly to the mining area. This track is held under a General Purpose Lease (L77/92) which is only 5m wide. L77/92 does not follow the track exactly because the track bends slightly around some trees, but the existing track will be used rather than the precise path of L77/92 to avoid the need to knock down any trees and widen the track unnecessarily. The only clearing required will be through a narrow strip of vegetation on private property just outside the Nature Reserve.

Access to the site along the northern firebreak of the Nature Reserve will be blocked at the eastern end to discourage visitors by this route.

Access to the site along the existing track within the Nature Reserve will not require any additional clearing within the Nature Reserve. This track is just wide enough to allow passage of the machinery and trucks. At one point there is a length of 60m which is prone to flooding and becomes boggy. This will be filled with 0.3m of gravel material from the mine and small pipes will be laid to act as culverts.

Existing drill lines will be used for access into the mine area, again with no extra clearing required.

A total of only about 300 tonnes of plant, fuel and chemicals will be transported to the site inside the Nature Reserve during the life of the project, along with contract earthmoving machinery. A larger but still small quantity of materials will be used outside the Nature Reserve. This quantity of trucking does not require large trucks and will be carried out with as little development as possible of the tracks within the Nature Reserve.

WATER SUPPLY.

Process water will be derived from two sources. Salty water is available from bores on site. These bores have not been installed, but three sites have been identified: the deep mineralised structure under the orebody, a quartz pegmatite outcrop east of the orebody near the proposed camp, and along the entrance track where there is a granite/greenstone contact.

One deep inclined drill hole intercepts the deep mineralisation at 74m vertically. This is 26m below the static water table of about 47m. A short pump test in April 1993 from 50m vertically, only just below the water table, stabilised at 14.7m^3/day. A water sample gave 40,000 ppm total dissolved solids (mostly sodium chloride) and a pH of 5.9. This water is salty, but not hypersaline, and is quite suitable for the gold extraction. A vertical bore hole next to the mining area would be used to intersect this structure at 125m. This bore would supply water directly to the process water pond by a conventional 75mm polythene pipe. The other structures would be drilled as needed, depending on the success of this first bore. Pipes would be required for short distances to bring water from these other bores to the mine area. This will be salty water and the pipes would need to be inspected frequently.

Fresh water is also available from nearby farm dams. Seven dams within 4.5km of the mine were surveyed in early April 1993, at the end of a dry summer. The dams were found to contain 9150m^3, and to have a capacity of 27,000m^3. Several other dams are available on the same properties but were not investigated. This water would be transported to the mine through 75mm polythene pipes laid on the ground. The pipes would be laid across pasture and through the Nature Reserve for short distances to avoid having to dig a trench to bury the pipes along the edge of the access track where vehicles are operating. The pipes would be laid by hand through the Nature Reserve, with no need to damage the vegetation. These pipes will carry only fresh water. The proponent has come to an agreement with the land owners for the use of this water.

The water balance for the treatment method, including evaporation, shows that 30,000m^3 is needed in the first year and 20,000m^3 in the second year. The farm dams are assumed to supply 18,000m^3 during the first four months of winter when the mine is set up and the bores 12,000m^3 per year.

If the bores fail or the water is not available from the farm dams due to drought, it would be possible to obtain water from the Perth to Kalgoorlie pipeline 6km to the south. The Water Authority of W.A. has stated that water is available but would be limited to 17,500m^3 per year. This water would be transported through a 40mm polythene pipe laid under Great Eastern Highway and under the railway by an existing culvert, across private property, and through the Nature Reserve for the last 700m. The pipe would be laid on the ground by hand through the Nature Reserve, mainly on an existing track. The route for this pipe has been examined to confirm that it is feasible and no problems were found. This water would be the most expensive and would only be used if it was necessary. No detailed study has been made of the route, but the landowner, Main Roads W.A. and Westrail have agreed in principle.

No dust problem is anticipated during the mining because there is no trucking and little vehicle movement will take place, and therefore no allowance has been made for water use in dust control.

The small quantities of potable water required for the use of people on site will be trucked from Westonia as required.

POWER SUPPLY AND FUELS.

A 12kW generator will be situated next to the processing plant to supply the pumps and the on site accommodation. A small diesel fuel supply will be required for this generator. The generator and fuel supply will be bunded and adjacent to the mine pit so that any spillage will drain under the vat liner.

The bulk fuel for the earthmoving machinery will be stored outside the Nature Reserve in suitable bunded tanks, and the machinery will drive up the existing track to be fuelled up as necessary. This will remove the need for fuel trucks to enter the Nature Reserve, and will remove the possibility of a major fuel spill within the Nature Reserve.

WORKFORCE.

During the initial development phase the workforce will consist of a manager, one plant operator and three mine workers. In addition there will be mechanics and electricians on site at various times. Local labour will be used as much as possible.

During the two to three year gold extraction period one plant process worker will be employed to operate and maintain the plant and pumps. For security and safety it is essential that this person lives on site. Theft of gold and equipment is a major problem at mine sites and the cyanide requires a degree of security.

During the second mining interval and the rehabilitation phase one plant operator and at least one mine worker will be required.

In addition there will be occasional employment of suppliers, transport agents, maintenance personnel, and specialist consultants.

ACCOMMODATION.

The workforce will be housed locally either in their own accommodation if they already live locally or in rented accommodation.

One person or a couple will be required to live on site. They would be housed in a fully equipped caravan, with a toilet and conventional septic tank system. A camp site will be constructed just east of the mine site (Figure 3) in a convenient natural clearing.

STORAGE, MAINTENANCE AND SERVICE FACILITIES.

All storage, maintenance and servicing will be carried out in the small leased area outside the Nature Reserve except where it is necessary to operate within the Nature Reserve, such as to service stationery machinery, carry out breakdown repairs or maintain the site facilities.

The only other facilities on site within the Nature Reserve would be a portable office/storeroom/lunchroom and a small roofed area as a workshop for on site open-air maintenance. These would be adjacent to the camp.

RUBBISH DISPOSAL.

All rubbish, wastes and excess materials will be removed from the Nature Reserve as soon as possible, and sold, recycled or dumped in the Westonia tip. Any stored materials, such as useful scrap, would be held outside the Nature Reserve.

5.4 DECOMMISSIONING AND REHABILITATION.

In the opinion of the project's mining consultant, what little gold may be discovered below the lateritic layer would not justify a future open pit at this site. If a deep deposit was found it would most likely be mined by underground mining, in situ leaching or a combination of these two. The mine plan is therefore based on immediate rehabilitation of the site.

Once the gold extraction has been completed the processing plant and cyanide injection system will be removed. The cyanide in the solution will be broken down by conventional peroxide chemical treatment into harmless products. Holes will be drilled through the plastic sheet to allow drainage and root penetration, and fresh water will be applied through the drippers to flush out the spent solution in the vat. This solution being flushed out will be less salty than the ground water because a mixture of ground water and fresh dam water will have been used and the evaporation will not have been sufficient to increase the salinity to that of the ground water. The water in the vat will become less salty as the flushing takes place and this can be tested by measuring the solution from the sump. The solution will pass down through the ground to the water table. The alkaline process water will be diluted and neutralised by the slightly acid ground water. Once the bores have been turned off the ground water will return to the original level. The heap will be 8m thick and would require 20 days of water applied at 7 litres/m^2/hour to replace the solution with clean water.

The water dam liner and all other items are then recovered for sale or dumping. The punctured plastic sheet, the drainage coils and the geotextile fabric under the heap cannot be recovered and will be buried.

The entire site will then be re-contoured with a bulldozer. It will not be possible to return the original surface because of swelling in the excavated material and there will be more material in the south than in the north, but the final contours will be made compatible with the original topography by bulldozing the surface down to the low slopes seen naturally on the site. The amount of earthmoving involved will have been minimised by the layout of the heap in the pit and the natural slope (Figure 4, next page). The deepest part of the pit will have been filled with the heap, and relatively little earthmoving will be required to remove the steep edges of the heap and shallow parts of the pit.

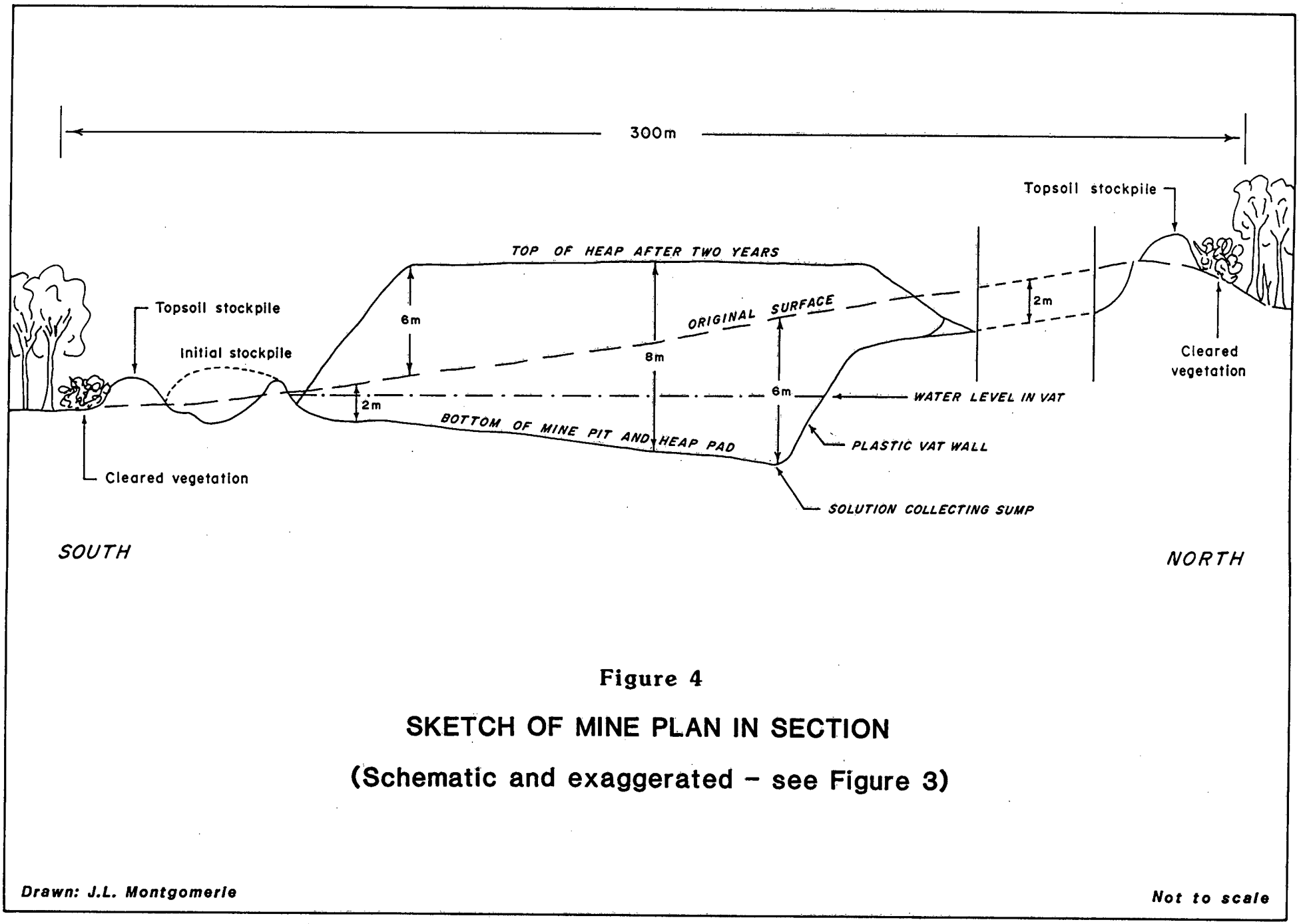


Figure 4

SKETCH OF MINE PLAN IN SECTION

(Schematic and exaggerated – see Figure 3)

Drawn: J.L. Montgomerie

Not to scale

The topsoil will then be restored and the vegetation will be returned to act as mulch and a seed source. Ripping will be used to break any soil compaction, and after the topsoil spreading.

The seed collected on the site before mining commenced will then be applied, and this will be supplemented by seed collected from adjacent vegetation during the life of the operation. This will be essential for species which do not retain their seed or do not have long-lived seed as these will not have been collected before the mining commenced. Plant regeneration will be allowed to take place naturally. No fertiliser will be used as this encourages weeds and no artificial watering will be used as this is not necessary and will not promote the establishment of self-sustaining vegetation native to the site.

To guard against a failure in the plant regeneration by unusual weather or some other factor such as excessive grazing by rabbits, some of the seed will be retained and could be used in hand planting. This may also be used with common and important species such as the Salmon Gum where natural establishment can be difficult. Hand planting would be carried out from pots using local soil to prevent the introduction of weeds or diseases.

The regenerating vegetation will be monitored. A particular watch will be kept for weeds, and species failing to regenerate may be applied as seed collected from adjacent land or as seedlings. Remedial action will be taken as necessary. The most likely action required will be rabbit control to protect the seedlings, and possibly some weed control.

Observation of the exploration lines suggests that much of the vegetation establishes well from seed. The subsoil (the orebody) appears to be homogeneous and is not expected to cause physical or biological problems in plant establishment. All topsoil will have been retained, and this should provide the ideal growing medium for the original vegetation as well as a considerable seed resource.

Rehabilitation will be regarded as complete when there is a good cover of self-sustaining native plants of sufficient density and diversity to eventually result in a reasonable approximation of the original vegetation. To define this, a quantitative study of the vegetation will be carried out once approval to mine has been

obtained. This would include the density of each species in plots and the plant cover of the strata in the vegetation. Completion criteria will be defined from this information in consultation with the Department of Conservation and Land Management.

These criteria would include:

- restoration of a set fraction of the original species diversity,
- sufficient density of plants to establish a plant cover resembling the original cover as the plants grow over time, and
- several years of survival of the developing vegetation without further inputs or maintenance.

The original vegetation has a low density and diversity, and restoration of this vegetation is not seen as difficult.

Rehabilitation will also include the access track, unless it is deemed desirable by CALM to keep this track open for its own purposes or for other mineral exploration which might take place (all of the surrounding land is held under tenements). In this case there is no topsoil to be spread and the track will be ripped, mulched with the adjacent vegetation, and seeded with seed collected adjacent.

Rehabilitation will also include the capping and burying of all old exploration holes in the Nature Reserve, and the closing of all old exploration tracks in the Nature Reserve. These are mainly around the mining area, but there are also lines along the eastern edge of the reserve. These lines would be closed by using logs from the mining area. The holes will be capped progressively during the mining operation so that by the end of the mining and rehabilitation work there will be no open holes remaining anywhere in the Nature Reserve. The vegetation on the blocked exploration lines can be expected to regenerate in time once vehicles are prevented from using the lines.

Information on rehabilitation is also available from work on the nearby Edna May mine, although seeding there has been mainly with a limited range of eucalypts, chenopods, Acacias and a few other species rather than the full range of native species.

5.5 TIMING.

The most suitable time to carry out the mining is summer when there are dry soils. It is planned to commence the operation in January/February 1994. This time is also convenient for the local workforce as there is a seasonal drop in the demand for labour during summer. The peak demands are during the harvesting and sowing.

Clearing the land at this time will minimise the impact on nesting birds.

This schedule also allows for maximum use of the dam water supplies during the wet period from May to August when excess water is normally wasted. The dams will then be able to refill before the summer and supply normal stock water.

The final decommissioning and rehabilitation would then be carried out just prior to the third winter after the project is commenced. Flushing may have to be carried out in the previous year to rehabilitation depending on the season when mining finishes. Just prior to winter is the optimum season for rehabilitation because natural seed germination and plant establishment takes place as soon as the rain falls. Supplementary seed from species which do not retain their seed will have been collected at the appropriate time in the preceding years.

6. PUBLIC CONSULTATION.

During development of the project, the proponent made contact with interested parties to obtain their input to the project, although all parties will be able to make submissions about this CER to the EPA. A written summary of the project and its possible impacts was prepared and distributed to interested parties. This was distributed to:

land owners and occupiers adjacent to the project,

the Shires of Westonia and Yilgarn,

the Westonia and Yilgarn Land Care Groups,

the Burracoppin, Walgoolan and Westonia Branch of the W.A. Farmer's Federation,

relevant State instrumentalities of CALM, the Department of Agriculture, the Water Authority of W.A., Westrail, Main Roads Western Australia, the EPA and the Department of Minerals and Energy, and

environmental groups in Perth represented by the Conservation Council of W.A. and the Australian Conservation Foundation.

In all cases these individuals or groups were asked for their comments, and were given the opportunity to talk to the proponent or its consultants as appropriate.

Local individuals and organisations either stated that they could see no problem with the project or supported the project because of the benefit it might bring to the area.

Government bodies made no comment or supplied technical information on relevant procedural matters.

The Conservation Council of Western Australia expressed a general opposition to mining in Nature Reserves, and would make comments on specific issues during the formal assessment of the CER.

As stated above, government policy allows mining in the Nature Reserve. No other issues which have not already been identified during the planning of the operation were identified during this consultation process.

7. ENVIRONMENTAL IMPACTS AND MANAGEMENT.

The major possible environmental impacts identified are:

* The loss of conservation values from the Nature Reserve by the temporary loss of the vegetation and habitats on the 6ha, or any permanent impact by failing to rehabilitate the site to the native vegetation.

* An impact on the specific conservation values.

* An impact on vegetation through water usage or spillage.

The minor possible environmental impacts identified are:

* Weeds, dieback or other diseases could be introduced to the Nature Reserve.

* Spillage of fuel, oils and other materials during normal operations could affect rehabilitation.

* Social impacts due to traffic, noise and dust.

These possible impacts are discussed here in the same order, and the measures taken to eliminate or control the impacts are discussed.

* The loss of conservation values from the Nature Reserve by loss of the vegetation and habitats on the 6ha or from any permanent impact.

The mine area will be completely disrupted during the mining and associated work. This cannot be avoided but the impact can be reduced by minimising the area to be cleared and corrected by carrying out rehabilitation to restore the original vegetation.

Several options were considered:

A conventional heap leach operation where the material is excavated and treated immediately adjacent to the mine pit.

A conventional heap leach but with the material trucked away and treated off the Nature Reserve.

A modified heap leach where an initial pit is excavated and the material is stacked up, and the remainder of the operation is carried out by stacking the material in the initial pit.

The first option uses the largest total area within the Nature Reserve and was not considered further. The second option uses less area for the mining but requires a disproportionately greater area for a haul road because it is necessary to have a wide road for haul trucks to operate. The third option was adopted because it uses the smallest possible area within the Nature Reserve. It uses a slightly larger mining area than option 2 but does not require a haul road and can make use of the existing access track to bring in machinery.

All other parts of the operation have been designed to minimise the area of disturbance. This includes dispensing with ponds and removing as many of the facilities as possible to outside the Nature Reserve. The operators have a financial incentive to limit the area of disturbance because this minimises the extent of rehabilitation which will be required.

Rehabilitation to the original native vegetation is a fundamental objective of the mining operation. The possible loss of part of the conservation estate is identified as the most important possible long term impact. The procedure has been described in Section 5.4 as part of the mining operation. Rehabilitation is seen as an integral part of the operation and will be carried out by the same people who carry out the mining, with any specialist input as required. The rehabilitation is based on:

- studying the vegetation before mining so that completion criteria can be established,
- collecting seed before clearing, and removing and storing the vegetation for use in rehabilitation,
- conserving all of the original topsoil and using this as a basis for regenerating the original vegetation,
- retaining the original subsoil,
- restoration of the topsoil and vegetation within a few years,
- seeding the restored topsoil with seeds from the site or immediately adjacent and retaining some seed for possible remedial actions, and

- monitoring the regenerating vegetation to see whether any remedial actions are required (such as rabbit control) and to ensure that the rehabilitation is successful when judged by set criteria.

Limiting the impact by minimising the area of disturbance and by carrying out good rehabilitation are seen as the most important environmental management actions required. In addition, to compensate for the short term loss of the values of the Nature Reserve while the land is cleared, all existing drill holes in Nature Reserve 18584 will be capped and buried, and all old exploration lines will be blocked so that spontaneous rehabilitation can occur. This has been described in Section 5.4.

* An impact on the specific conservation values.

There are no occurrences of rare flora known on the site.

The most important rare animal identified on the site is Carnaby's Black-Cockatoo. A survey of the mine site was carried out to count the number of trees which were large enough to be potential nesting trees. There were 29 trees within the mining area, and 21 of these were in the area to be excavated. The other eight were in the area to be used for stockpiling vegetation and topsoil and these would not need to be removed. These large trees are mainly on the western and northern sides of the mine site. The loss of such a small number of trees will not have a significant impact on this species, given that there is probably 1,000ha of woodland in the two Nature Reserves as well as large trees on other land nearby.

The land clearing will be carried out in summer when these birds are not breeding to ensure that there is no direct impact on the population. The Salmon Gum is regarded as the most important species which provides nest hollows, and particular care will be taken to ensure that Salmon Gums are present in the rehabilitated vegetation.

It will take many decades before the regenerated trees are large enough to provide potential nest hollows. The small trees in Plate 1 and the coppiced trees in Plate 2 probably date from before 1925. Although it will take many years to grow large trees, these trees will eventually be an asset because of the current regional paucity of young trees.

* An impact on vegetation through water usage or spillage.

The natural vegetation would not make use of the ground water because the water is too salty, and would be dependent on the water in the 47m of soil above this level. The water table will be lowered by pumping of this salty water for use as process water, but this is unlikely to affect the vegetation because the resting water table is so deep. If there is fresh water resting on the salty water it will only be available to deep-rooted species which have penetrated to this depth. After decommissioning, the cyanide will be broken down and the former process water will be flushed back down to the water table with fresh water. This water will be less salty than the ground water because of the fresh dam water which will have been added, but will eventually join the salty ground water and be diluted out. Once the bores are turned off the water table will return to its original level.

The process water will be salty but will be entirely contained within the pond and vat which are lined. The bore water will be salty and the only opportunity for spillage will be in pumping from the bore to the water pond. The main bore will be immediately adjacent to the pond. Longer pipes would be needed if other bores are required, but these will be adjacent to the operation and would be inspected routinely to detect leaks which would damage the vegetation. This would be carried out as part of the normal work of the resident process operator.

The water from the farm dams and the possible source represented by the Perth to Kalgoorlie pipeline will be fresh and any leaks would not cause a significant environmental impact. The pipes would be inspected routinely to detect leaks and prevent wastage, but they would be inspected less often than with any salt water pipes, and no adjacent vehicle track would be required.

* Weeds, dieback or other diseases could be introduced to the Nature Reserve.

There are many weeds which could invade the mine site, although most will not persist in intact native vegetation. These could become a nuisance in rehabilitation and weeds will be excluded by bringing only clean machinery onto the site.

There is only a small chance that dieback due to the Phytophthora fungi could become established, but other soil diseases could occur. The introduction of any diseases will be prevented by the cleaning of vehicles which enter the site.

Vehicles would normally be cleaned before they approach the site, but could be cleaned at the entrance to the Nature Reserve. The total number of vehicle movements will not be high because the earthmoving machinery will remain within the Nature Reserve until each segment of the work is completed and the cleaning of vehicles will not be difficult. In practice most vehicles would be parked outside of the Nature Reserve. The only vehicle which would regularly enter the Nature Reserve would that of the resident operator.

* Spillage of fuel, oils and other materials during normal operations could affect rehabilitation.

Any material can be spilt by accident. The chance of a spillage will be reduced by normal good management practices. There is a financial incentive to reduce spillages because they represent wasted materials. The most difficult materials are fuel and oil because they do not break down readily.

The design of the site also minimises the probability of materials escaping. The treatment plant and generator will be adjacent to the leach vat so that any spills will automatically pass into or under the vat respectively.

All spillages will be cleaned up by removing the affected soil as necessary, and burying it in the heap or removing it from the site.

* Social impacts due to traffic, noise and dust.

The extent of trucking required for the operation is very small (see Section 5.3), might amount to a few trucks a week. This is well within the normal use of the local roads. There is one resident on a presently little used section of Kaolin St/Della Bosca Rd who will experience a significant increase in traffic. This resident has small children, but owns the land where the mine access track and facility outside the Nature Reserve will be situated, and has come to an agreement with the proponent to limit vehicle speeds around the house.

The mine site itself is remote, and 3km from the nearest residence. There will be no problem with noise, lights or dust disturbing local residents.

8. SUMMARY OF COMMITMENTS.

The proponent has made the following commitments. With each commitment the mechanism for responsibility for carrying out the work and the definition of completion are given.

Number/ Section.	Commitment.
1. 5.2	The operation will be designed to disturb the smallest possible area of the Nature Reserve, and as many facilities and activities as possible will be located outside the Nature Reserve. Responsibility for action: proponent. Regulatory authority: integral part of the design of the project.
2. 5.2	Before and during clearing, seed of as many species as possible with long-lived seed will be collected from the site, and all vegetation and topsoil will be conserved. Responsibility for action: proponent. Regulatory authority: CALM.
3. 5.2	Cyanide and caustic soda will be transported and handled in accordance with established regulations. Responsibility for action: proponent. Regulatory authority: Department of Minerals and Energy.
4. 5.3	The existing access track will be used rather than the precise path of L77/92 to avoid the need to knock down trees and widen the track unnecessarily, and existing tracks will be used within the Nature Reserve with minimal upgrading. Responsibility for action: proponent. Regulatory authority: CALM.

5. 5.3 Any pipes carrying salt water will be inspected routinely to detect leaks which might damage vegetation.

Responsibility for action: proponent.

Regulatory authority: Department of Minerals and Energy.

6. 5.3 The main fuel storage will be outside the Nature Reserve.

Responsibility for action: proponent.

Regulatory authority: Department of Minerals and Energy.

7. 5.3 Rubbish disposal will be outside the Nature Reserve.

Responsibility for action: proponent.

Regulatory authority: Department of Minerals and Energy.

8. 5.4 The process water will be treated and flushed out of the heap by leaching with fresh water.

Responsibility for action: proponent.

Regulatory authority: Department of Minerals and Energy.

9. 5.4 The land will be returned to slopes compatible with the original topography, and all topsoil and vegetation will be returned.

Responsibility for action: proponent.

Regulatory authority: CALM.

10. 5.4 Seed collected from before mining and subsequently from adjacent areas will be applied, and hand planting of seedlings will be used if necessary.

Responsibility for action: proponent.

Regulatory authority: CALM.

11. 5.4 The regenerating vegetation will be monitored and remedial actions taken as required.

Responsibility for action: proponent.

Regulatory authority: CALM.

12. 5.4 A quantitative study of the vegetation will be carried out, once approval to mine has been obtained, to determine completion criteria for rehabilitation in consultation with CALM.

Responsibility for action: proponent.

Regulatory authority: CALM.

13. 5.4 Rehabilitation will extend to the existing access track, and all pre-existing drill holes on the Nature Reserve will be capped and buried, and all pre-existing drill lines on the Nature Reserve will be blocked.

Responsibility for action: proponent.

Regulatory authority: CALM.

14. 7. The site will be rehabilitated to the original vegetation in accordance with pre-determined success criteria.

Responsibility for action: proponent.

Regulatory authority: CALM.

15. 7. The land clearing will be carried out in summer when Carnaby's Black-Cockatoo is not breeding to ensure that there is no direct impact on the population.

Responsibility for action: proponent.

Regulatory authority: CALM.

16. 7. The introduction of weeds and dieback will be controlled by cleaning vehicles and restricting the entry of most vehicles to the Nature Reserve.

Responsibility for action: proponent.

Regulatory authority: CALM.

9. ACKNOWLEDGEMENTS.

All available information on the Nature Reserves in the area was made available by CALM (Merredin). Information on rehabilitation being carried out at the nearby Edna May mine was made available by Normandy Poseidon.

The mine planning and integration of the environmental requirements into the mining was carried out by Paul A. P. Lewis of Terra-Sources of East Victoria Park.

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APPENDIX 1. EPA guidelines for the project.

PROPOSAL	:	MINING AND HEAP LEACHING OF A LATERITE GOLD DEPOSIT IN C CLASS NATURE RESERVE 18584
LOCATION	:	WESTONIA
PROPONENT	:	RUTHERFORD RESOURCES P/L
SUBJECT	:	CONSULTATIVE ENVIRONMENTAL REVIEW GUIDELINES

Overview

In Western Australia all environmental reviews are about protecting the environment. The fundamental requirement is for the proponent to describe what they propose to do, to discuss the potential environmental impacts of the proposal, and then to describe how those environmental impacts are going to be managed so that the environment is protected. If the proponent can demonstrate that the environment will be protected then the proposal will be found environmentally acceptable, if the proponent cannot show that the environment would be adequately protected then the Environmental Protection Authority (EPA) would recommend against the proposal.

Throughout the process it is the aim of the EPA to advise and assist the proponent to improve or modify the proposal in such a way that the environment is protected. Nonetheless, the environmental review in Western Australia is proponent driven, and it is up to the proponent to identify the potential environmental impacts, and design and implement proposals which protect the environment.

For this proposal protecting the environment means that the natural and social values associated with the nature reserve are protected. Where they cannot be protected, proposals to mitigate the impacts are required.

These Guidelines identify issues that should be addressed within the Consultative Environmental Review (CER). They are not intended to be exhaustive and the proponent may consider that other issues should also be included in the document.

The CER is intended to be a brief document, its purpose should be explained, and the contents should be concise and accurate as well as being readily understood by interested members of the public. Specialist information and technical description should be included where it assists in the understanding of the proposal. It may be appropriate to include ancillary or lengthy information in technical appendices.

Key issues

The important issues for this proposal are likely to be associated with the location of the proposal being in a nature reserve. The nature reserve is for the purpose of conservation of flora and fauna.

The key issues for the project should be clearly identified and the content of succeeding sections determined by their relevance to these issues.

In this case the key issues should include:

- Water supply and management issues
  - supply (source, quantity, quality, storage and contingencies for water supply failure);
  - groundwater impacts (abstraction from bores and potential for saline leachate impacts);
  - surface water impacts (discharge of saline water onto vegetation and into drainage lines); and
  - management of leaks from saline supply lines.
- Flora and fauna issues
  - flora and fauna survey (rare flora and fauna; priority of poorly know flora and fauna, description of vegetation associations)

- presence or absence of nesting hollows and species utilising the hollows (including representation and conservation status of these species locally, with particular emphasis on security in conservation reserves, to determine if the area proposed for mining is adequately represented and preserved locally outside the area to be mined); and
- protection of surrounding flora and fauna (eg limited clearing, fire, weeds and saline runoff and overspray).

- Rehabilitation issues
  - overburden and topsoil management;
  - rehabilitation of site to values compatible with surrounding nature reserve (flush saline water and chemicals from exhausted heap, subsequently remove or sufficiently puncture plastic liner and contour land appropriately);
  - use of local flora species, monitoring and contingency plans;
  - outline proven rehabilitation methods and give examples; and
  - review opportunities to enhance the reserve through land addition or some other action.
- Operational management issues
  - alternative treatment sites and demonstrate why treatement can not occur off-site;
  - dust and noise control (including impacts on native fauna);
  - location of infrastructure (roads, pipeline, storage of fuels and chemicals, contingencies for chemical spills or leaks, workshop and office facilities, organic waste disposal);
  - waste management (oils, scrap etc.);
  - pest and weed control; and
  - decommissioning.
- Ethnographic and archaeological issues;

plus any other key issues raised during the preparation of the report.

Public participation and consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. This section should describe the activities undertaken, the dates, the groups and individuals involved and the objectives of the activities. This section should be cross referenced with the "environmental management " section which should clearly indicate how community concerns have been addressed. Where these concerns are dealt with via other departments or procedures, outside the Environmental Protection Authority process, these can be noted and referenced here.

Monitoring programs

The proponent should recognise that ongoing monitoring will be required for certain aspects of the proposal, especially groundwater impacts and rehabilitation, and commit to putting a program in place to manage these issues.

Detailed list of environmental commitments

The commitments being made by the proponent to protect the environment should be clearly defined and separately listed. Where an environmental problem has the potential to occur, there should be a commitment to rectify it. They should be numbered and take the form of:

a) who will do the work;
b) what the work is;
c) when the work will be carried out; and
d) to whose satisfaction the work will be carried out.

All actionable and auditable commitments made in the body of the document should be numbered and summarised in this list.

APPENDIX 2. List of the vertebrate fauna which may occur in woodlands in the mine area or in the sandplains near the access track.

Introduced species are identified by an asterisk.

FROGS AND REPTILES.

		Woodland	Sandplain
LEPTODACTYLIDAE	**Frogs**		
Crinia pseudinsignifera		X	
Heleioporus albopunctatus			X
Limnodynastes dorsalis		X	X
Myobatrachus gouldii			X
Neobatrachus kunapalari		X	X
N. pelobatoides		X	X
N. sutor		X	X
Pseudophryne guentheri		X	
P. occidentalis		X	
GEKKONIDAE	**Geckos**		
Crenadactylus o. ocellatus		X	X
Diplodactylus assimilis		X	X
D. granariensis granariensis		X	
D. maini		X	X
D. pulcher		X	X
D. spinigerus inornatus		X	X
Gehyra variegata		X	X
Heteronotia binoei		X	X
Nephrurus stellatus			X
Oedura reticulata		X	
Rhynchoedura ornata		X	X
Underwoodisaurus milii		X	
PYGOPODIDAE	**Legless Lizards**		
Delma australis		X	X
D. fraseri		X	X
Lialis burtonis		X	X
Pygopus lepidopodus		X	X
P. nigriceps nigriceps		X	X
AGAMIDAE	**Dragon Lizards**		
Ctenophorus cristatus		X	
C. maculatus griseus			X
C. reticulatus		X	
C. salinarum			X
C. scutulatus			X
Moloch horridus			X
Pogona m. minor		X	X

	Woodland	Sandplain
SCINCIDAE **Skinks**		
Cryptoblepharus plagiocephalus	X	X
Ctenotus impar		X
C. mimetes	X	X
C. p. pantherinus		X
C. schomburgkii	X	X
C. u. uber		X
C. xenopleura		X
Egernia inornata		X
E. multiscutata bos	X	X
E. richardi	X	
Eremiascincus richardsonii	X	X
Hemiergis i. initialis	X	X
Lerista gerrardii	X	X
L. macropisthopus macropisthopus		X
L. muelleri		X
Menetia greyii	X	X
Morethia butleri	X	
M. obscura	X	X
Tiliqua occipitalis		X
T. r. rugosa	X	X
VARANIDAE **Monitors**		
Varanus gouldii	X	X
V. t. tristis	X	X
TYPHLOPIDAE **Blind Snakes**		
Ramphotyphlops australis	X	X
R. bituberculatus	X	X
R. hamatus	X	X
R. waitii	X	X
BOIDAE **Pythons**		
Aspidites ramsayi		X
Liasis stimsoni stimsoni	X	X
Morelia spilota imbricata	X	X
ELAPIDAE **Elapid Snakes**		
Demansia psammophis cupreiceps	X	X
Denisonia fasciata	X	X
Echiopsis curta		X
Furina ornata	X	X
Neelaps bimaculatus	X	X
Pseudechis australis	X	X
Pseudonaja affinis affinis	X	X
P. modesta	X	X
P. nuchalis	X	X
Rhinoplocephalus gouldii	X	X
R. monachus	X	X
R. nigriceps	X	X
Simoselaps bertholdi	X	X
S. f. fasciolatus		X
S. s. semifasciatus	X	X

BIRDS.

	Woodland	Sandplain
DROMAIIDAE		
Dromaius novaehollandiae, Emu	X	X
ACCIPITRIDAE		
Elanus notatus, Black-shouldered Kite		X
Lophoictinia isura, Square-tailed Kite	X	X
Haliastur sphenurus, Whistling Kite	X	X
Accipiter fasciatus, Brown Goshawk	X	X
A. cirrhocephalus, Collared Sparrowhawk	X	X
Aquila audax, Wedge-tailed Eagle	X	X
Hieraaetus morphnoides, Little Eagle	X	X
Circus assimilis, Spotted Harrier		X
FALCONIDAE		
Falco peregrinus, Peregrine Falcon	X	X
F. longipennis, Australian Hobby	X	X
F. berigora, Brown Falcon		X
F. cenchroides, Australian Kestrel		X
PHASIANIDAE		
Coturnix novaezealandiae, Stubble Quail		X
TURNICIDAE		
Turnix varia, Painted Button-quail	X	X
T. velox, Little Button-quail		X
OTIDIDAE		
Ardeotis australis, Australian Bustard		X
BURHINIDAE		
Burhinus magnirostris, Bush Thick-knee	X	X
COLUMBIDAE		
Phaps chalcoptera, Common Bronzewing	X	X
Ocyphaps lophotes, Crested Pigeon	X	X
CACATUIDAE		
Calyptorhynchus magnificus, Red-tailed Black-Cockatoo	X	
C. latirostris, Carnaby's Black-Cockatoo	X	X
Cacatua roseicapilla, Galah	X	X

	Woodland	Sandplain
LORIIDAE		
Glossopsitta porphyrocephala, Purple-crowned Lorikeet	X	
POLYTELITIDAE		
Polytelis anthopeplus, Regent Parrot	X	
Nymphicus hollandicus, Cockatiel	X	X
PLATYCERCIDAE		
Melopsittacus undulatus, Budgerigar	X	X
Platycercus icterotis, Western Rosella	X	X
Barnardius zonarius, Port Lincoln Ringneck	X	X
Psephotus varius, Mulga Parrot	X	X
Neophema elegans, Elegant Parrot	X	X
CUCULIDAE		
Cuculus pallidus, Pallid Cuckoo	X	X
C. pyrrhophanus, Fan-tailed Cuckoo	X	X
Chrysococcyx osculans, Black-eared Cuckoo		X
C. basalis, Horsfield's Bronze-Cuckoo	X	X
C. lucidus, Shining Bronze-Cuckoo	X	X
STRIGIDAE		
Ninox novaeseelandiae, Southern Boobook	X	X
TYTONIDAE		
Tyto alba, Barn Owl	X	X
PODARGIDAE		
Podargus strigoides, Tawny Frogmouth	X	X
AEGOTHELIDAE		
Aegotheles cristatus, Australian Owlet-nightjar	X	X
CAPRIMULGIDAE		
Caprimulgus guttatus, Spotted Nightjar	X	X
ALCEDINIDAE		
Halcyon sancta, Sacred Kingfisher	X	
MEROPIDAE		
Merops ornatus, Rainbow Bee-eater	X	X

	Woodland	Sandplain
HIRUNDINIDAE		
Cheramoeca leucosternum, White-backed Swallow		X
Hirundo neoxena, Welcome Swallow	X	X
Cecropis nigricans, Tree Martin	X	X
MOTACILLIDAE		
Anthus novaeseelandiae, Richard's Pipit		X
CAMPEPHAGIDAE		
Coracina novaehollandiae, Black-faced Cuckoo-shrike	X	X
Lalage sueurii, White-winged Triller	X	X
MUSCICAPIDAE		
Drymodes brunneopygia, Southern Scrub-robin		X
Petroica multicolor, Scarlet Robin	X	
P. goodenovii, Red-capped Robin	X	X
Melanodryas cucullata, Hooded Robin	X	X
Eopsaltria griseogularis, Western Yellow Robin	X	
Microeca leucophaea, Jacky Winter	X	
Pachycephala pectoralis, Golden Whistler	X	X
P. rufiventris, Rufous Whistler	X	X
Colluricincla harmonica, Grey Shrike-thrush	X	X
Oreoica gutturalis, Crested Bellbird		X
Myiagra inquieta, Restless Flycatcher	X	
Rhipidura fuliginosa, Grey Fantail	X	X
R. leucophrys, Willie Wagtail	X	X
TIMALIIDAE		
Pomatostomus superciliosus, White-browed Babbler		X
SYLVIIDAE		
Cinclorhamphus mathewsi, Rufous Songlark	X	X
C. cruralis, Brown Songlark		X
MALURIDAE		
Malurus pulcherrimus, Blue-breasted Fairy-wren	X	X

	Woodland	Sandplain
ACANTHIZIDAE		
Sericornis brunneus, Redthroat		X
Smicrornis brevirostris, Weebill	X	X
Gerygone fusca, Western Gerygone	X	X
Acanthiza apicalis, Inland Thornbill	X	X
A. uropygialis, Chestnut-rumped Thornbill	X	X
A. chrysorrhoa, Yellow-rumped Thornbill	X	
NEOSITTIDAE		
Daphoenositta chrysoptera, Varied Sittella	X	
CLIMACTERIDAE		
Climacteris rufa, Rufous Treecreeper	X	
MELIPHAGIDAE		
Anthochaera carunculata, Red Wattlebird	X	
Acanthagenys rufogularis, Spiny-cheeked Honeyeater	X	X
Manorina flavigula, Yellow-throated Miner	X	X
Lichenostomus virescens, Singing Honeyeater		X
L. leucotis, White-eared Honeyeater	X	X
L. cratitius, Purple-gaped Honeyeater	X	X
L. ornatus, Yellow-plumed Honeyeater	X	
Melithreptus brevirostris, Brown-headed Honeyeater	X	X
Lichmera indistincta, Brown Honeyeater	X	X
Phylidonyris albifrons, White-fronted Honeyeater	X	X
P. melanops, Tawny-crowned Honeyeater		X
EPHTHIANURIDAE		
Ephthianura tricolor, Crimson Chat		X
E. albifrons, White-fronted Chat		X
DICAEIDAE		
Dicaeum hirundinaceum, Mistletoebird	X	X
PARDALOTIDAE		
Pardalotus punctatus, Spotted Pardalote	X	X
P. striatus, Striated Pardalote	X	X

		Woodland	Sandplain
ZOSTEROPIDAE			
Zosterops lateralis,	Silvereye	X	X
PLOCEIDAE			
Poephila guttata,	Zebra Finch	X	X
GRALLINIDAE			
Grallina cyanoleuca,	Australian Magpie-lark	X	X
ARTAMIDAE			
Artamus personatus,	Masked Woodswallow	X	X
A. cinereus,	Black-faced Woodswallow	X	X
A. cyanopterus,	Dusky Woodswallow	X	X
CRACTICIDAE			
Cracticus torquatus,	Grey Butcherbird	X	X
C. nigrogularis,	Pied Butcherbird	X	X
Gymnorhina tibicen,	Australian Magpie	X	X
Strepera versicolor,	Grey Currawong	X	X
CORVIDAE			
Corvus coronoides,	Australian Raven	X	X
C. bennetti,	Little Crow	X	X

MAMMALS.

	Woodland	Sandplain
TACHYGLOSSIDAE		
Tachyglossus aculeatus, Short-beaked Echidna	X	X
DASYURIDAE		
Dasyurus geoffroii, Chuditch	X	X
Sminthopsis dolichura, Common Dunnart	X	X
S. crassicaudata, Fat-tailed Dunnart	X	
S. granulipes, White-tailed Dunnart		X
Ningaui yvonneae, Yvonne's Ningaui	X	X
BURRAMYIDAE		
Cercartetus concinnus, Western Pygmy-possum	X	X
MACROPODIDAE		
Macropus fuliginosus, Western Grey Kangaroo	X	X
M. robustus, Common Wallaroo	X	X
M. rufus, Red Kangaroo	X	X
MOLOSSIDAE		
Tadarida australis, White-striped Mastiff-bat	X	X
Mormopterus planiceps, Little Mastiff-bat	X	X
VESPERTILIONIDAE		
Nyctophilus geoffroyi, Lesser Long-eared Bat	X	X
Chalinolobus gouldii, Gould's Wattled Bat	X	X
Scotorepens greyii, Little Broad-nosed Bat	X	X
S. balstoni, Western Broad-nosed Bat	X	X
Eptesicus regulus, King River Eptesicus	X	X
MURIDAE		
Pseudomys albocinereus, Ashy-grey Mouse		X
P. bolami, Bolami's Mouse	X	
Notomys mitchelli, Mitchell's Hopping-mouse		X
Mus musculus, House Mouse*		X

		Woodland	Sandplain
LEPORIDAE			
Oryctolagus cuniculus,	Rabbit*		X
CANIDAE			
Vulpes vulpes,	Fox*		X
FELIDAE			
Felis catus,	Feral Cat*		X