

# **Opal Mining within the Narran-Warrambool Reserve, Lightning Ridge**

## **Review of Environmental Factors**

April 2004

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NSW DEPARTMENT OF PRIMARY INDUSTRIES | MINERALS

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Review of Environmental Factors

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# Executive Summary

## Introduction and Background

Opal mining within the Lightning Ridge region is undertaken within the Narran-Warrambool Reserve, the boundaries of which are the Queensland New South Wales state border to the north, the Narran River to the west, the Big Warrambool River to the east and the Barwon River to the south. Within the reserve, mining is centred on the township of Lightning Ridge, located 74 kilometres north of Walgett and 50 kilometres due south of the Queensland-New South Wales border. Mining within the Reserve occurs currently within three Opal Prospecting Areas (OPAs 1-3), with a fourth Opal Prospecting Area proposed (OPA 4) which is the subject of this current REF.

The purpose of this REF is to consider the environmental impacts from existing and future opal mining and prospecting operations within the Narran-Warrambool reserve. The approach taken in preparing this REF has been to examine the impact of the existing mining operations and the effectiveness of mitigation/rehabilitation measures in order to assess the sustainability of ongoing operations within OPAs 1, 2 and 3 and the measures needed to allow mining/prospecting to commence in OPA 4.

## Planning and Approvals

The Mining Act 1992 is the principal Act by which the opal fields are managed and administered. Granting of mineral claims and opal prospecting licences is undertaken under this Act, which specifies procedures for granting a mineral claim or opal prospecting licence, conditions that can be imposed, and claim holder rights and obligations. The Act also provides for penalties to be handed out for failing to comply with provisions of the Act.

The Department of Mineral Resources is the public authority responsible for the regulation of mining in New South Wales, and as such the granting of a mineral claim or opal prospecting licence under the Mining Act 1992 can be considered to be an "activity" within the definition of Section 111 of the Environmental Planning and Assessment Act 1979. Therefore opal mining requires environmental impact assessment under Part 5 and Department of Mineral Resources is a determining authority for this activity due to its regulatory role defined under the Mining Act 1992.

## Environmental Impact Assessment

An assessment of the anticipated effects on the environment of the proposed mining activities within OPA 4 has been undertaken in accordance with Section 111 of Part 5 of the Environmental Planning and Assessment Act 1979 and Clause 228 of the Environmental Planning and Assessment Regulations 2000. The anticipated environmental impacts are summarised in Table S.1.

**Table S.1: Overview of Anticipated Environmental Impacts**

	<b>Anticipated environmental impact</b>
Water Management	Opal mining activities have minor impacts on both surface and ground water resources.
Geology and Soils	The principal impacts on soils associated with opal mining operations are related to erosion, compaction and subsidence.

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### **Anticipated environmental impact**

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<i>Flora and Fauna</i>	<i>The major impact associated with flora and fauna is the clearing of native vegetation. Vegetation within the ridge country when most opal mining occurs has been heavily cleared in the past and therefore has a high conservation value. Adopting a broad-scale, precautionary approach to impact assessment there is likely to be a significant impact on threatened species listed under both the Threatened Species Conservation Act 1995 and the Environment Protection and Biodiversity Conservation Act 1999.</i>
<i>Cultural Heritage</i>	<i>Opal mining has been an integral part in the establishment and development of Lightning Ridge and surrounding area. The activities associated with mining that today impact on the historic heritage landscape have also contributed to this landscape. The existence of the cultural landscape of opal mining today is very much based on practices that have had a detrimental impact on Aboriginal cultural sites and places. Continuation of these activities also threatens the preservation of the historic mining landscape that defines Lightning Ridge from other opal mining towns in New South Wales.</i>
<i>Climate and Air Quality</i>	<i>Air quality issues associated with the opal mining industry relate to emissions from petrol or diesel powered plant and equipment and dust generation.</i>
<i>Land Use</i>	<i>The major impact of mining activities on land use is the clearing and modification of land making it unsuitable for grazing. Opal mining operations tend to exclude grazing activities for safety reasons as well as loss of grasses in the vicinity of mines.</i>
<i>Noise and Vibration</i>	<i>Impacts associated with noise and vibration are likely to be minimal.</i>
<i>Hazard Assessment</i>	<i>Impacts from opal mining include the potential risk of injury or death resulting from easy access to mining areas, particularly preserved fields, by the general public and risk to the environment from spillage or improper disposal of fuel, oil and lubricants used for plant and equipment.</i>
<i>Visual Assessment</i>	<i>Almost all activities associated with mining have a visual impact, for example the construction of mining infrastructure, clearing of vegetation and stockpiling of mullock. Excavated subsurface materials from mines are predominately white and contrast strongly with generally red topsoils.</i>
<i>Access</i>	<i>Impacts related to access include the proliferation of tracks within the Western Land Leases and a lack of rehabilitation of this infrastructure.</i>
<i>Social and Economic Aspects</i>	<i>Impacts of mining on social and economic aspects have generally been positive. The township of Lightning Ridge was founded to service the mining community. The nature of this community has been shaped by the people attracted to the opal mining industry. Opal mining has a flow on effect in creating jobs in retail, tourism and hospitality industries.</i>
<i>Waste and Resources</i>	<i>Wastes generated by opal mining include mullock, fines from puddling, oils, lubricants, sewage and discarded machinery. Old mining areas can contain a significant amount of rubbish and discarded machinery and car bodies.</i>
<i>Cumulative Impacts</i>	<i>The main cumulative impact will result from vegetation clearing associated with mining combined with vegetation clearing for agriculture.</i>
<i>Ecologically Sustainable Development</i>	<i>Opal mining and the proposed mitigation measures would be generally in accordance with the principles of ecologically sustainable development.</i>

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### **Mitigation and Environmental Management**

*Environmental issues related to opal mining within the Narran-Warrambool reserve are currently treated through a compliance approach, regulated by regional staff from the Department of Mineral Resources. The Mining Act 1992 provides in part for the control of activities within mineral claims. However, this control becomes less effective as the number of registered claims within a localised areas increase significantly. In such cases a management plan is prepared for the field in order to ensure responsible management.*

*Associated with the management process is a series of bonds aimed at ensuring that processes such as the rehabilitation of finished mine sites is undertaken.*

*Most of the management process is however concerned with safety issues such as the closing of mine shafts, rather than true environmental issues.*

*In this REF a range of mitigation measures have been recommended specific to the environmental impacts outlined in Table S.1. These are consolidated into a range of management recommendations that include:*

- *carrying out additional investigations in order to plan for the opening of OPA 4 such that significant impacts are avoided as is the need for an Environment Protection and Biodiversity Conservation Act referral or a Species Impact Statement at the level of a mineral claim;*
- *Department of Mineral Resources to create the role of environmental/aboriginal liaison officer to implement and monitor environmental best practice;*
- *adopting the Department of Mineral Resources proposal to increase the size of mineral claims to one hectare;*
- *implementing a program of revegetation of mineral claims in addition to the rehabilitation currently carried out;*
- *increasing the security deposit associated with mineral claims to fully account for the cost of rehabilitation and revegetation; and*
- *implementing a yearly environmental levy that would pay for the revegetation and rehabilitation of currently abandoned mineral claims.*

*With the opening of OPA 4, the Department of Mineral Resources has the opportunity to implement a program to ensure that opal mining can occur in the region while at the same time promoting conservation and biodiversity needs. This will mean that opal mining within OPA 4 can proceed in an environmentally sound and sustainable manner.*



# 1. Introduction

## 1.1 Background

Opal has been mined at Lightning Ridge, located in central northern New South Wales, since the early 1900s. From that time, the town has developed as a result of both the opal mining industry and the surrounding agricultural activity in the area.

Opal mining is presently carried out in three defined Opal Prospecting Areas (OPAs 1 to 3) located within the Narran-Warrambool Reserve which comprises approximately 5,000 square kilometres and incorporates the Lightning Ridge township (*Figure 1.1*). Approximately 6,000 mineral claims exist at the present time of which 500 to 800 are mined on a regular basis and 2,000 mined on a casual basis.

The New South Wales Department of Mineral Resources (DMR) is responsible for regulating the opal mining activity under the *Mining Act 1992*. In addition, the Department Of Mineral Resources is responsible for conducting environmental assessment of the mining operations as an “activity” under Part 5 of the *Environmental Planning and Assessment Act 1979*. This environmental assessment is required prior to granting or renewing each opal prospecting licence or mineral claim.

This Review of Environmental Factors (REF) has been prepared by Parsons Brinckerhoff on behalf of the Department of Mineral Resources to provide a framework for the environmental impact assessment process of future mineral claims. It assesses the impacts of current opal mining operations and the potential impacts of operations in a new proposed opal prospecting area (OPA 4). The REF also assesses the effectiveness of existing mitigation measures and safeguards and proposes new or improved measures (where required) to ensure mining can continue to be undertaken in an environmentally sustainable manner.

## 1.2 Locality Description

Opal mining within the Lightning Ridge region is undertaken within the Narran-Warrambool Reserve, which lies mainly within the Walgett local government area and partly in the Brewarrina local government area. The reserve was gazetted in 1989 under Section 24 of the then *Mining Act 1973* to limit exploration licences within the area. The reserve boundaries are the Queensland New South Wales state border to the north, the Narran River to the west, the Big Warrambool River to the east and the Barwon River to the south. Within the reserve, mining is centred on the township of Lightning Ridge, located 74 kilometres north of Walgett and 50 kilometres due south of the Queensland-New South Wales border (*Figure 1.1*).

Mining for opals occurs within the Lightning Ridge Mineral Claims District (which mirrors the area of the Narran-Warrambool Reserve), one of two districts set up in New South Wales under Section 173 of the *Mining Act 1992* (the other Being White Cliffs Mineral

Claims District) to allow miners to explore and extract opals on a small scale. Mineral claims are currently restricted to less than one quarter hectare in size.

Most land within the Narran-Warrambool Reserve is Crown Land held under Western Lands Lease and administered by the Department of Infrastructure, Planning and Natural Resources. Opal mining is generally only viable on ridge environments of the region, with the main competing land uses being sheep and cattle grazing.

The reserve contains four Opal Prospecting Areas (*Figure 1.1*):

- OPA 1 – comprising 414 square kilometres and incorporating areas surrounding the township of Lightning Ridge and extending approximately 25 kilometres to the west. This Opal Prospecting Area includes the Lightning Ridge and Cocooran Fields;
- OPA 2 – comprising 1,340 square kilometres and extending up 50 kilometres to the north of Lightning Ridge. This Opal Prospecting Area includes the New Angledool and Mehi fields;
- OPA 3 – comprising 572 square kilometres and extending up to 80 kilometres south west of Lightning Ridge. This Opal Prospecting Area includes the Grawin, Glengarry, Sheepyards, Carter's Rush and Mulga Rush fields; and
- OPA 4 – comprising 1606 square kilometres. This is a draft Opal Prospecting Area and no mining activities are currently approved in this area.

Within each Opal Prospecting Area, land is made available for opal prospecting within Opal Prospecting Blocks, which are constituted under Section 224 of the *Mining Act 1992* and can be up to 500 hectares in size.

Within OPAs 1-3 there are approximately 6,000 mineral claims occupying a total areas of 19 square kilometres. In addition to the mineral claims is the area covered by associated infrastructure such as access tracks.

Mineral claims are not spread evenly over an Opal Prospecting Area and their locations will often be clustered around significant opal finds. This can be clearly seen in *Figure 1.1* as white soils against the brown background. When more than twenty mineral claims are made within a local area, the Department of Mineral Resources can nominate the area as an opal field.

**Figure 1.1: Location of Opal Prospecting Areas within the Narran-Warrambool Reserve**



## 1.3 Study Approach

The purpose of this REF is to consider the environmental impacts from existing and future opal mining and prospecting operations within the Narran-Warrambool reserve. The approach taken in preparing this REF has been to examine the impact of the existing mining operations and the effectiveness of mitigation/rehabilitation measures in order to assess the sustainability of ongoing operations within OPAs 1, 2 and 3 and the measures needed to allow mining/prospecting to commence in OPA 4.

Due to the large size of the study area, a sensitivity based approach has been taken in relation to future mining and prospecting activities. This identifies areas of higher environmental sensitivity, which require specific mitigation measures or further site specific investigations prior to mining or prospecting activities.

This document is designed to provide a framework to allow the Department of Mineral Resources to assess environmental impact assessments prepared for each Mineral Claim.

## 1.4 Approval Process

### 1.4.1 Environmental Planning and Assessment Act 1979

Part 5 of the *Environmental Planning and Assessment Act 1979* requires that public authorities consider the potential environmental effects of their decisions where development consent is not required. The obligation under Section 111 of the *Environmental Planning and Assessment Act 1979* is to:

*“examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.”*

As the Department of Mineral Resources is the public authority responsible for the regulation of mining in New South Wales, the granting of a mineral claim or opal prospecting licence under the *Mining Act 1992* (see below) can be considered to be an “activity” within the definition of Section 111 of the *Environmental Planning and Assessment Act 1979*. Therefore opal mining requires environmental impact assessment under Part 5 and the Department of Mineral Resources is a determining authority for this activity due to its regulatory role defined under the *Mining Act 1992*. Where other approvals are required for specific mining activities to occur, additional determining authorities may exist. Related legislation and approvals are discussed in *Section 3*.

The factors that must be considered in conducting environmental assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* are listed in Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. These factors are reproduced in *Appendix A* and a checklist provided referencing where they are assessed within this REF.

Section 5A of the *Environmental Planning and Assessment Act 1979* details factors that must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. These eight factors are commonly referred to as the Eight Part Test and are repeated in Section 94 of the *Threatened Species Conservation Act 1995* (Section 4.3.2). Section 6.3 of this REF is concerned with flora and fauna and presents the results of the Eight Part Tests.

#### **1.4.2 Mining Act 1992**

The *Mining Act 1992* is the principal Act by which the opal fields are managed and administered. Granting of mineral claims and opal prospecting licences is undertaken under this Act, which specifies procedures for granting a mineral claim or opal prospecting licence, conditions that can be imposed, and claim holder rights and obligations. The Act also provides for penalties to be handed out for failing to comply with provisions of the Act.

The process to be followed for the granting of opal prospecting licences and mineral claims is described in detail in *Section 3* of this REF.

Part 11 of the Mining Act relates to environmental protection and states that in deciding whether or not to grant a mineral claim, the New South Wales Minister of Mineral Resources or mining registrar is to take into account the need to conserve and protect flora and fauna. The Minister or mining registrar may cause such studies (including environmental impact studies) to be carried out as the Minister or mining registrar considers necessary to enable such a decision to be made.

### **1.5 Structure of this Review of Environmental Factors**

The structure and content of this Review of Environmental Factors is described below.

This assessment includes:

- Chapter 2 - Opal Mining Operations. Details current mining operations and plant and equipment used;
- Chapter 3 - Regulatory Processes. Details current regulatory processes applying to mining operations and permits and licences that apply;
- Chapter 4 - Regional and Planning Context. Provides an overview of the human and natural environment and the requirements of the relevant legislation and policies in relation to opal mining;
- Chapter 5 - Stakeholder and Authority Issues. Describes the issues identified during consultation with the local community and relevant authorities;
- Chapter 6 - Environment Assessment. Describes the existing physical environment, details the possible impacts of the proposal in relation to air, soil, water, flora, fauna, heritage, waste, noise, visual and social aspects, and provides mitigation measures to be adopted;

- Chapter 7 - Environmental Management. Outlines the environmental management process including permits, establishment of an environmental management system and mitigation measures; and
- Chapter 8 – Conclusion. Summarises the conclusions of the REF and key impacts of opal mining.



## 2. Opal Mining Operations

### 2.1 Overview

Opal was first discovered in the Lightning Ridge area by European settlers in the 1880s, with the first recorded sale of opal in 1903 by Jack Murray and Charles Nettleton (Leechman, 1982). In the early days mines were dug by hand and opal production was limited. With the advent of mechanised mining in the late 1950s, however, production increased substantially.

The black opal mined at Lightning Ridge is a unique and highly valued gemstone. It is generally found at 6 to 18 metres below ground level in the deeply weathered claystone layer of the Graman Creek formation of early Cretaceous age. This forms a distinct layer below the overlying sandstones and conglomerates of Tertiary age.

Opals at Lightning Ridge are found in two forms: rounded nodules, termed 'nobbies,' or in seams. The opal bearing material is a soft greyish claystone often referred to as 'opal dirt.' Opal is generally extracted by underground mining and a typical mining operation involves sinking a vertical shaft and driving horizontal shafts, or 'levels,' to obtain opal dirt. Some open cut mining is also undertaken in the area.

In areas, where opals are found as 'nobbies', opal dirt is brought to the surface where it is transported by truck to a puddling site for processing. Methods for processing the opal dirt typically include wet (or sometimes dry) puddling techniques usually by mechanical means. This puddling breaks up the claystone, the finer portion of which is then discarded, leaving rock materials which are further examined and hand sorted to identify individual nobbies.

In areas where opals are found in seams, gemstones are usually recovered at the working face of the mine.

Mining generally occurs along defined low ridgelines (so called 'ridge country') where the opal bearing material is closer to the surface. There are more than 200 distinct opal fields that occur on the 'ridge country'. These opal fields may be isolated or occur in groups. The main opal field "groups" located at Lightning Ridge are; Coocoran, Grawin/Carter's, Glengarry/Sheepyards, Wyoming, Jag Hill and Mehi (Johansson, 2003).

As discussed in *Section 1.2*, opal mining at Lightning Ridge takes place within Opal Prospecting Areas (OPAs) which are within the Narran-Warrambool reserve. There are currently three opal prospecting area (OPAs 1-3) designated within the Narran-Warrambool Reserve. To the south of OPA 3, is OPA 4 which is still in draft form and adjacent to the Narran Lake Nature Reserve. Opal mining or prospecting is yet to be approved in this area.

Each Opal Prospecting Area is further subdivided into opal prospecting blocks within which prospecting and mining activities may be undertaken. Individuals may obtain opal prospecting licences or mineral claim licences from the Department of Mineral Resources to prospect for and mine opals within an opal prospecting block.

## **2.2 Prospecting**

Mineral exploration for opals is termed prospecting, conducted under an opal prospecting licence or Mineral Claim.

Prospecting generally involves drilling auger holes using a truck mounted rig. Recovered material is then visually inspected to check for colour. Drilling is also used to verify the depth of the opal bearing claystone layer. Department of Mineral Resources reports that the average number of holes drilled per licence was 28 holes in 2002 (Department of Mineral Resources, 2003). The number of holes drilled is only restricted by the miner's budget with prospectors generally drilling between 10 and 100 holes on a given licence.

Prospectors are required to backfill test holes in accordance with Department of Mineral Resources' standards.

## **2.3 Mining Methods**

Opal mining takes place within a Mineral Claim using methods outlined below.

### **2.3.1 Underground Mining**

Underground mining is the most common method employed in the opal fields surrounding Lightning Ridge. This method involves sinking a shaft through the sandstone and conglomerate layers, either by hand or with one metre auger, to reach the claystone, where 'levels' are then dug horizontally through potential opal bearing material. These 'levels' are dug either by hand or using power tools such as jackhammers or underground hydraulic digging machines.

The claystone mined from the 'levels' is brought to the surface by motorised hoist or winch where it is transferred to a truck for transport to a processing operation. Larger operators use a 'blower' that works like a large vacuum-cleaner, drawing the claystone to the surface through a series of pipes. There are in excess of 200 blowers in use at Lightning Ridge.

Mines with large excavations, called 'ballrooms', require propping to support the roof and reduce the risk of cave-ins. Timber props are the most common type of support used and are commonly constructed from Cypress Pine (*Callitris glaucophylla*), which is either sourced locally or from the Pilliga Scrub.

### **2.3.2 Open Cut**

Open cut mining involves excavating a large area with a bulldozer, cutting through thin layers of sandstone until the claystone level is reached. This kind of mining is generally restricted to areas where there has been previous significant underground working, or where subsidence has occurred. Once complete, open cut mines must be backfilled and revegetated.

Separate approval is required from the Department of Mineral Resources to establish an open cut within a mineral claim.

### **2.3.3 Processing**

Two common techniques are applied to processing of opal dirt – wet puddling and dry puddling.

Wet puddling operations typically serve 10 to 20 individual mining operations. *Photographs 2.1 and 2.2* show the elements of a typical wet puddling operation. The typical arrangement comprises separate water supply and sediment settling dams divided by an earthen mound on which are located a series of transit mixers – the rear mixer portion of concrete trucks that have been removed from the vehicle. The opal dirt is delivered and transferred into the transit mixers and water is pumped from the water supply dam and mixed with the opal dirt. The finer portion of the material sinks to the bottom and is released into the sediment dam. The coarse fraction is transferred onto a tray at the back of the mixer and hand sorted using some additional water to remove the remaining fines.

Dry puddling employs the same principals as wet puddling, only using a mechanical action to break up the dirt, instead of water. The machinery can be driven by a small motor, or by hand. This method is generally less efficient than wet puddling and is generally used to reduce the bulk of the opal dirt before it is transported to a remote wet puddling site.



Photograph Credit: Hugh Swinbourne

**Photograph 2.1: Wet Puddling Operations including a Series of Transit Mixers**



Photograph Credit: Hugh Swinbourne

**Photograph 2.2: Hand Sorting of Material in a Wet Puddling Operation**

#### **2.3.4 Management of Mullock and Waste**

Waste soil and rock from mining operations is termed 'mullock'. This material is removed immediately from the site and delivered to one of a series of centralised mullock dumps established throughout the Reserve by the Department of Mineral Resources. Some mullock is stored on site to backfill any shafts left after mining is concluded.

Centralised mullock dumps were introduced over 12 years ago through progression of mining practices and as a response to changes in rehabilitation standards. Centralised mullock dumps are not required on preserved fields.

When a dump is full the dump area is either revegetated or retained to be utilised as material for filling shafts. The Department of Mineral Resources is currently evaluating a number of applications by private individuals to reprocess the material found in mullock dumps in the area.

### **2.3.5 Fossicking and Noodling**

Fossicking is a lawful activity under the Mining Act and is not subject to a licence. It is a popular activity for tourists to the opal fields.

Fossicking must be undertaken using hand-held tools and Department of Mineral Resources does not permit:

- use of explosives or power-operated equipment;
- excavation or vegetation clearance;
- damage to or removal of any bush rock; or
- removal of more than 100 grams of gemstones during any single period of 48 hours.

Fossickers must replace any soil, rock or other material that has been disturbed in the course of fossicking for materials.

A noodler is a person who goes over discarded mullock heaps and abandoned open cut mines. Typically a noodler uses a sieve and rake with potential opals identified by eye, or with some large scale operators, using a conveyer belt and ultra-violet light to detect opals. Noodling on mullock dump sites is an illegal activity.

Fossicking is allowed on crown lands provided the consent of the holder is first obtained.

### **2.3.6 Rehabilitation**

The term rehabilitation, in this REF, refers to the reinstatement of the land to its pre-mining condition. This includes the securing of a site to ensure mine shafts are sealed, Auger holes are back filled and mullock is moved to a designated dump (in the case of new fields). *Appendix B* contains a copy of the Department of Mineral Resources' *Rehabilitation Standards for Cancelled Claims* and the *Safety-minimum Standards Required for Securing Shafts and Auger Holes on Registered Claims*.

Rehabilitation does not generally include revegetation although the Department of Mineral Resources now require that this be undertaken following the completion of the rehabilitation process.



## 3. Regulatory Regime

### 3.1 Agencies and Organisations

#### 3.1.1 Department of Mineral Resources

The New South Wales Department of Mineral Resources is responsible for administering mineral exploration and mining in the State under the *Mining Act 1992*. As such it is responsible for granting or renewing of authorities, mineral claims and opal prospecting licences.

Specifically, the Department of Mineral Resources is responsible for:

- assessing and reporting on the geology of New South Wales, especially by preparing geological maps and notes;
- ensuring that exploration and mining companies comply with environmental requirements;
- issuing exploration and mining titles;
- monitoring health and safety at mines; and
- encouraging development of the mining industry in the State and value adding to mineral products.

The Department's Lightning Ridge Office provides a variety of services to the mining industry in the region including:

- processing of exploration and mining titles, including mineral claims and opal prospecting licences;
- monitoring of mine safety and environmental management; and
- mine safety courses.

#### 3.1.2 Lightning Ridge Mining Board

The Lightning Ridge Mining Board acts in an advisory capacity to the Minister on policy development for opal mining in Lightning Ridge.

The Board is a body comprising representatives of organisations and Government agencies that have a major interest in the controlled and responsible development of the Lightning Ridge opal fields.

The purpose of the Board is to ensure that the policies implemented by the Department of Mineral Resources for the opal mining industry in Lightning Ridge reflect the interests of parties directly affected by opal mining such as farmers, graziers and miners associations.

### **3.1.3 Lightning Ridge Miner's Association**

The Lightning Ridge Miner's Association (LRMA) was incorporated in 1974 to represent the opal mining community of the Lightning Ridge region. The charter of the LRMA is to represent opal miners in dealings with government agencies and other bodies in relation to the economic and social welfare of miners.

The LRMA has 650 members (2002 figures) and is administered by a President and board of nine elected Directors.

### **3.1.4 Glengarry Grawin Sheeppark Miner's Association**

The Glengarry Grawin Sheeppark Miner's Association (GGsMA) was founded in 1987 to represent the miners of the area west of Cumborah/Goodong roads. The objective of the GGsMA is to represent miners in liaison with government and semi-government bodies.

The GGsMA has 210 members (2003 figures) and is administered by four executives (President, Vice-President, Secretary and Treasurer) and a committee of eight. The GGsMA and the LRMA work together in the interest of opal mining.

The area administered by the GGsMA includes OPA 4.

## **3.2 Permits and Licences**

### **3.2.1 Opal Prospecting Licence**

Prospecting for opals is dealt with in Part 10 of the *Mining Act 1992*. Prospecting can be undertaken after obtaining an opal prospecting licence from the Department of Mineral Resources. The licence restricts prospecting to any one designated opal prospecting block. No prospecting blocks are located over the main Lightning Ridge opal field. The prospecting licence covers an area of between 20 and 500 hectares (dependent on the size of the opal prospecting block) and lasts for a period of three months. If the opal prospecting block has been licensed more than three times in the preceding 12 calendar months, the licence is only valid for 28 days. The licence gives the holder exclusive rights to prospect and apply, during the currency of the licence, for an opal mining claim.

Prospecting restricts the miner to drilling only, with the driving of a prospective opal 'level' not permitted.

An application for an opal prospecting licence is made on Form 27 of the Department of Mineral Resources and must be accompanied by a security deposit. The condition of an opal prospecting licence requires the holder to submit a report on all prospecting conducted on the licence including a plan showing the location of all drill holes and a drill hole log sheet.

### 3.2.2 Mineral Claim

Opal mineral claims are issued by the Department of Mineral Resources and are restricted to two per person and must be square in shape and up to 50 metres by 50 metres in size. Mineral claims are granted for twelve months and may be renewed annually. Before the granting of the claim, the applicant must notify the landholder with written intention to apply for the claim. Applicants that have not previously held a claim may be required to attend a mining course. Where privately owned land is involved, the consent of the owners must be obtained and they can veto a claim. Occupiers of crown land, such as under Western Land Leases, can object to a mineral claim on the grounds that the land is agricultural land. Mineral claims can be used for mining and prospecting. The claim holder is not permitted to carry out open cutting or wet or dry puddling except with the written approval of the Mining Warden. In 2002, a total of 5,909 mineral claims were recorded in the opal fields of the Narran-Warrambool Reserve. Corkery (2001) notes that almost 1,700 are residential claims located mainly in the preserved fields. Of the remaining non-residential claims 500 to 800 claims are mined on a regular basis, 2,000 are mined on a casual basis and the remaining claims are not mined at all.

Residential claims can be either renewed annually, or for the term of five years, whereas non-residential claims must be renewed annually.

As prescribed in the *Mining Act 1992* Regulations (2003) a claim must be marked out using a steel picket or wooden posts (at least 75 millimetres thick) placed at each corner and protruding at least one metre out of the ground. Trenches one metre long and 150 millimetres deep must be dug from each corner post along the direction of the claim boundaries, if this is not practical a row of rocks of the same length and height can also be used.

Within the Lightning Ridge area, mineral claims are granted within a mineral claims district gazetted under Section 173 of the *Mining Act 1992*.

Currently, application for a mineral claim must be in writing and be accompanied by:

- a description of the area sought;
- the appropriate lodgement fee; and
- a copy of the notice served to the landholder.

There are a number of conditions associated with mineral claims that relate to environmental management including air and water pollution, vegetation clearing and disturbance of Aboriginal artefacts. However, security bonds associated with mineral claims are largely directed towards rehabilitation of the site in terms of safety and there is little in the way of environmental assessment at this stage of the process.

### 3.2.3 Mining Leases for Associated Infrastructure

Specific mining leases have been established to provide for centralised facilities such as puddling operations and mullock dumps.

Prior to the granting of a mining lease for associated infrastructure the following information must be supplied to the Department of Mineral Resources and lodged with the application:

- a survey diagram of the area sought;
- particulars of reserves, roads, catchment areas affecting the land;
- a plan of the area suitable for use in a newspaper advertisement; and
- the prescribed fee.

For wet puddling operation, the applicant is also required to undertake the following (Department of Mineral Resources 1999b):

- submit for approval, a satisfactory Review of Environmental Factors (REF) for the proposed operation;
- provide certified evidence, that the soils to be used for the construction of the silt dam walls have been tested by a competent authority and have been found to be suitable for that purpose;
- design and construct the silt dam and by-wash channels in a manner consistent with the engineering guidelines laid down by the Department of Infrastructure, Planning and Natural Resources and provide certified evidence, prior to the commencement of operations, that construction has been consistent with those guidelines;
- provide evidence that an adequate supply of water for puddling will be available under normal operating circumstances; and
- demonstrate, prior to the granting of a title, that there is a full understanding of the requirements and methods to be adopted to rehabilitate the area affected by the puddling operations and a commitment to fulfil those obligations.

Mineral claims may be granted for the purpose of dumping, stockpiling or depositing overburden and mullock. The size of such claims may be up to two hectares in size. The granting of such a claim is subject to the Mining Registrar being satisfied that:

- a need for such a dump exist;
- alternative dumps are not readily available for use or are not reasonably accessible;
- all reasonable efforts have been made to reach agreement with the affected land holder but there has been a failure to reach agreement; and
- the “opal field” in need of the mullock dump has reasonable expectations of significant future development (Department of Mineral Resources 1999).

Responsibility for ongoing maintenance of the dump and final rehabilitation (in particular the cost of such works) rests with the claim holder. However, the Department of Mineral Resources, or other organisations, may enter into an arrangement in relation to this matter.

The amount of security deposit to be lodged is determined by the Mining Registrar, (having taken due advice from the field officers).

### **3.2.4 Opal Mining Agreement**

An opal mining agreement is a legal arrangement between a registered claim holder and a miner giving the miner permission to mine the registered claim. The agreement sets out the rights of parties, the costs and responsibilities to be carried by each and the division of gross sales between the parties.

### **3.2.5 Property Access**

The *Mining Act 1992* provides that the holder of a mineral claim is entitled to a right of way between the claim and the nearest practicable point of a public road. Further, a mining registrar may grant a permit to any person to enter any land so as to enable the person to mark out a proposed mineral claim or to comply with the conditions of a mineral claim.

For the purpose of carrying out prospecting the holder of a prospecting title may not carry out prospecting operations on any land otherwise than in accordance with an access arrangement either agreed between the holder of the title and each landholder, or determined by an arbitrator in accordance with the *Mining Act 1992*.

The *Western Lands Amendment Act 2002*, will rationalise access tracks to properties. However existing opportunities for access by miners as contained in the *Mining Act 1992* will not be affected by the amendments to the Western Lands Act.

### **3.2.6 Restricted Areas (Gazetted and Policy Reserves)**

Reserves are used to exclude the granting of prospecting and mining titles over land included in the reserve for the purposes of protecting environmental features or agricultural lands. The reserve can either be “gazetted reserves” or “policy reserves”. Gazetted reserves are imposed by the Department of Mineral Resources at the request of landholders or other government agencies such as the National Parks and Wildlife Service. These reserves are generally designed to protect areas such as wildlife refuges. Policy reserves are initiated by the landholder through the Lightning Ridge Mining Board and relate to farming activity. Policy reserves can be imposed for short periods of time and are designed to be more flexible than the formal gazetted reserves.

### **3.2.7 Opal Field Management Plans**

Opal Field Management Plans are designed to manage any issues created by Opal Mining activities that are not covered by the *Mining Act 1992* and are developed between the miners and the landholder. The plans ensure that the land degraded/adversely affected by opal mining activities is fully rehabilitated and restored into a useful productive condition (refer NSW Farmers and Landholders representatives 2003).

The booklet “A Management Plan for New Opal Fields” (Lightning Ridge Mining Board, 1997) outlines the process that is undertaken in the preparation of a management plan. In general a plan is produced for an area declared as a ‘new field’, with more than 20 claims registered after a period of little or no activity. Plans of management are then

drawn up through a process of consultation with miners, landholders and relevant government agencies.

The Management Plans detail specific requirements in relation to:

- Water Management;
- Roads and Tracks;
- Puddling Sites;
- Stock Management;
- Dogs and Firearms;
- Waste Management, including Mullock and Rubbish Dumps;
- Improvements; and
- Buffer Zones.

### **3.2.8 Rehabilitation Policy**

A rehabilitation policy for the opal fields of the Narran-Warrambool reserve has been developed (Interim Lightning Ridge Mining Board, 1995).

The aim of the policy is to develop a hierarchy of rehabilitation actions for rehabilitating land for pastoral or other specific purposes.

The key principles for rehabilitation stated in the policy include:

- removal and/or ripping of all roads as identified in the Management Plan;
- removal of all plant, equipment, services and facilities unless approved otherwise by the Department of Mineral Resources and the landowner;
- ripping of all compacted surfaces caused by mining;
- removal of all rubbish;
- backfilling of all open cuts and shafts; and
- rehabilitation of Puddling sites in accordance with the lease conditions.

### **3.2.9 Security Deposits, Lodgement Fees and Compensation Funds**

The *Mining Act 1992* allows for the Department of Mineral Resources to attach conditions to mineral claims and opal prospecting licences including the payment of a security deposit. The security deposit is collected to ensure rehabilitation of claims that have been abandoned. Deposits are held in trust by the Department of Mineral Resources and are refunded once a claim has been cancelled and the Department of Mineral Resources are satisfied that rehabilitation of the claim has been carried out.

Claim holders are required to abide by claim conditions 6 to 9 under the Conditions of a Mineral Claim, Lightning Ridge Mineral Claims District by which the rehabilitation and

environmental responsibilities of claim holders can be enforced. These conditions can be summarised as;

- Condition 6 – ensuring the claim area is left clean and tidy;
- Condition 7 – refers to the redistribution of topsoil and wastes;
- Condition 8 – operations being carried out without causing undue pollution; and
- Condition 9 – states that the claim area is to be maintained in a proper state of cleanliness at all times.

The current security deposit for new and transferred mineral claims is \$250 for non-residential claims and \$200 for residential claims. The security deposit for an Opal Prospecting Licence is set at \$350 with a \$35 non-refundable bond for Opal Prospecting Licences in Opal Prospecting Area 3.

The *Mining Act 1992* permits a single combined security deposit to be lodged in respect of either a number of mineral claims or a number of opal prospecting licences. However, in some cases, an opal miner holds both mineral claims and opal prospecting licences.

Currently, the *Mining Act 1992* requires an application for Opal Prospecting Licences to be accompanied by a lodgement fee (\$250). Where an Opal Prospecting Licence is subject to ballot, the administrative work of collecting the fee and then refunding the fee to all but the ballot winner can be significant. One ballot in 2002 involved over 600 applicants.

Deposits for open cut mines can be significant and generally range from \$12,000 to \$20,000 on the preserved fields, and up to \$85,000 on the new fields.

Miners also contribute towards a compensation scheme for landholders. The scheme was developed by farmer and miners on the Interim Lightning Ridge Miners Board. Miners pay \$40 per claim into a compensation pool and distributions are made from this pool to affected land-holders (\$10 contributes toward a road fund). Compensation is distributed to land-holders based on the principles that compensation:

- be allocated on a per acre basis; and
- takes into account the claim density.

Generally a basic amount of four dollars per acre is provided as compensation in the following proportions:

- more than one claim per 30 acres – 100 percent compensation;
- one claim per 30-60 acres – 50 percent compensation;
- one claim per 60-100 acres – 20 percent compensation;
- less than one claim per 100 acres – 7.5 percent compensation; and
- where 100 percent compensable and stock are run on the paddock, an agistment component is deducted.

### **3.2.10 Camps on Claims**

The Department of Mineral Resources has declared certain parts of the opal fields in Lightning Ridge to be “preserved fields,” with miners camps permitted in these areas, with consent of the land holder. Preserved fields include the “permissive occupancy” (Peroc) on the outskirts of Lightning Ridge and the Grawin/Glengarry settlement. Only holders of residential claims are permitted to build camps. Council must be notified when a camp begins to be occupied, or when building of the camp is finished. The holder of the mineral claim on which there is a camp is required to apply for residential status in respect to that claim. In “non preserved fields” no new camps, or extensions to existing approved camps are permitted (Walgett Shire Council, 1977).

Planning controls associated with preserved fields are discussed in *Section 3.5*.

The Mining Act currently prescribes a distance of 200 metres around dwelling houses, within which a mineral claim cannot be granted other than with the consent of the owner. However, this does not currently apply to “camps on claims”.

As part of the settlement of the long-running “camps on claims” issue at Lightning Ridge, it has been agreed to regularise the current practice of establishing permanent homes on mineral claims by granting “western lands leases for residence” within the Preserved Fields on the Narran-Warrambool Reserve. This area is termed the “permissive occupancy” area or ‘peroc’. The 200 metre distance, which did not previously apply to these camps, would then apply if no changes were made to the *Mining Act 1992*.

## 4. Regional and Planning Context

### 4.1 Natural Environment

The Narran-Warrambool Reserve lies in the central north region of the Murray Darling Basin (MDB), Australia's largest drainage system. The inland river system of the MDB encompasses approximately 14 percent of the total area of Australia and provides water for more than three million people with around 70 percent of all water used for agriculture in Australia used by irrigation in the Basin. The principal rivers in this area are the Barwon, Bokhara and Narran Rivers. Since European settlement, these river systems have been extensively modified through regulation (the construction of weirs and dams), vegetation clearing and agricultural activity. The Lightning Ridge area is located on the south-eastern corner of the Great Artesian Basin. A combination of artesian bore water and surface water sources are utilised for domestic, agricultural or mining uses (CRC Freshwater Ecology, 2002).

Two landforms dominate the landscape of the Reserve; a floodplain comprising unconsolidated Quaternary aged sediments at an elevation of 140 metres above sea level, and ridge country about 30 metres higher than the floodplain comprising Tertiary aged sedimentary rocks underlain by Early Cretaceous rocks. Opal bearing claystone is found at a depth of 6 to 18 metres below ground in the ridge country.

The Narran-Warrambool Reserve is made up of three primary Land Systems. The main Land System, where the majority of mining and prospecting occurs, is the Lightning Ridge Land System that is characterised by undulating gravely red ridges with slightly sloping sandy plateaux and drainage lines. Vegetation is characterised by: dense white cypress pine, bumble box, mulga and silver-leaf ironbark; clumps of budda; wire grass, buck Spinifex, mulga grass, galvanized burr and forbs.

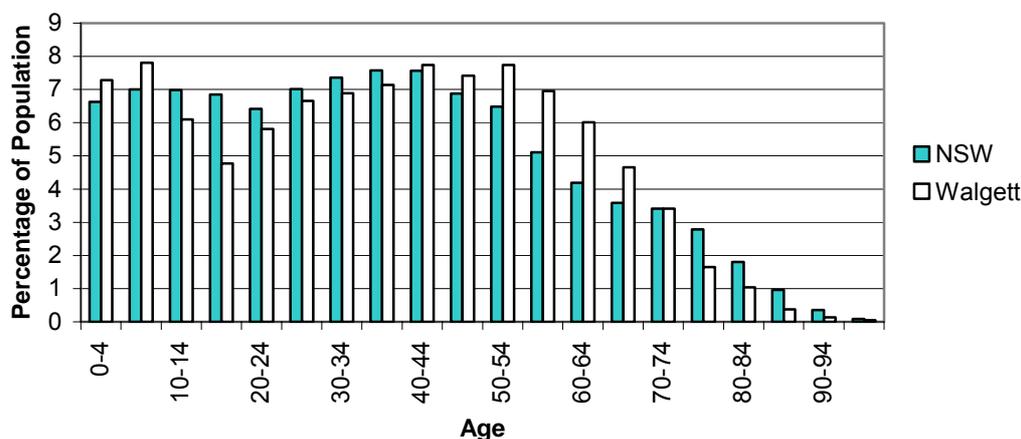
Adjacent and lower in the landscape is the Rotten Plain Land System which is characterised by low-lying drainage plains with cracking clay soils that are periodically inundated and vegetated with coolibah and swamp wilga. The soils of the Rotten Plain Land System are often referred to as "black soils." Also occurring in the region and smaller in area is the Llanillo Land System that is the timbered floodplain of the upper Barwon River. This Land System comprises of grey clays and brown texture-contrast soils with dense to scattered coolibah, belah, bumble box, myall, whitewood and Mitchell grasses and saltbushes.

The history of land use by Europeans extends back to the 1830s with early exploration carried out by Major Thomas Mitchell. By about 1848 all the land in the region had been settled and used for sheep and cattle (Goodwin, 2002). The cultivation of rain fed crops occurs mainly in small low-lying areas around Lightning Ridge. There has been selective clearing of native vegetation to improve agricultural productivity since the beginning of European occupation. Mining around Lightning Ridge began in the early 1900s.

## 4.2 Human Environment

Within the Walgett Local Government Area, which encompasses the whole of the Narran-Warrambool Reserve, the 2001 census shows that there were 8,104 residents, 1,753 of whom live in the township of Lightning Ridge. These numbers are likely to be an underestimation since there are numerous miners unofficially residing within the reserve whose official place of residence is likely to be elsewhere in New South Wales or interstate. Approximately 8,200 people collect mail from the Lightning Ridge post office and this may better reflect the true number of people working within the area (Maxine O'Brien, *personal communication*).

The age of the population is relatively spread (*Figure 4.1*), although compared to the population of New South Wales as a whole, Walgett local government area has more residents between 40 and 70 years and fewer teenaged children. However, Lightning Ridge has both a high school and a primary school that have over 500 students.



**Figure 4.1: Population Age Distribution for Walgett and New South Wales as a Whole (Data from the Australian Bureau of Statistics 2001 Census)**

The population of the Walgett Local Government Area is multicultural with more than ten percent of the population born outside of Australia and twenty percent of Aboriginal or Torres Strait Islander decent. Many Aboriginal people mine within the area. The majority of those born outside of Australia are of European descent, with the United Kingdom, New Zealand and Yugoslavia making up the greatest proportions (*Table 4.1*). The diversity of backgrounds of the population is strongly reflected in many of the cultural aspects of the region. For example, the Lightning Ridge Bore Baths are an important cultural element of the town and are part of the attraction for migrants.

The lifestyle associated with opal mining and the overall climate of Lightning Ridge is a major attraction for many miners. Some miners have transferred from the South Australian opal fields because at Lightning Ridge mining can occur throughout the summer.

**Table 4.1: Country of Birth for the Walgett Population as a Whole and Lightning Ridge**

Country	Number of People	
	Walgett	Lightning Ridge
Australia	6,515	1,304
Canada	11	3
China	21	0
Croatia	48	25
Fiji	10	6
France	4	3
Germany	65	22
Greece	8	5
India	9	3
Indonesia	3	0
Ireland	15	3
Italy	10	4
Lebanon	3	0
Macedonia	6	3
Malta	3	0
Netherlands	17	3
New Zealand	111	33
Philippines	26	12
Poland	8	3
South Africa	8	3
Turkey	3	0
United Kingdom	179	48
United States of America	19	8
Yugoslavia, Federal Republic of	108	41
Born elsewhere overseas	234	88

Note: Data from the Australian Bureau of Statistics 2001 Census.

As would be expected, a large proportion (17 percent) of males within Lightning Ridge lists their occupation as miners (*Table 4.2*). However, support services such as retail, education, health and accommodation/cafes and restaurants overall make up a significant proportion of the population's employment. This is in contrast to Walgett as a whole, where agriculture makes up the largest proportion of people in the Shire.

**Table 4.2: Listed Industry for Male and Female Residents of Lightning Ridge**

Industry	Lightning Ridge (percent)			Walgett (percent)
	Males	Females	Total	
Agriculture, Forestry and Fishing	2.9	2.2	2.5	28.2
Mining	17.0	3.2	10.5	4.5
Manufacturing	7.4	2.9	5.3	4.0
Construction	8.3	1.1	4.9	4.1
Wholesale Trade	7.4	4.0	5.8	4.3
Retail Trade	13.1	20.9	16.8	10.5
Accommodation, Cafes and Restaurants	8.0	12.6	10.2	6.1
Transport and Storage	0.0	3.2	1.5	2.5
Communication Services	1.9	0.0	1.0	0.8
Finance and Insurance	1.0	1.1	1.0	0.7
Property and Business Services	1.9	4.7	3.2	3.2
Government Administration and Defence	4.8	7.6	6.1	5.6
Education	5.4	16.5	10.7	8.6
Health and Community Services	8.0	14.0	10.8	7.9
Cultural and Recreational Services	1.0	2.2	1.5	0.7
Personal and Other Services	6.7	1.1	4.1	3.8
Not stated	5.1	2.9	4.1	4.4

Note: Data from the Australian Bureau of Statistics 2001 Census.

The tourist industry centred on opal mining accounts for a high proportion of retail, accommodation and café/restaurant employment. The census data shows a large number of visitors to the area (*Table 4.3*), with over 11 percent from a different area in Australia or overseas. Lightning Ridge attracts over 80,000 visitors per year.

**Table 4.3: Australian State of Usual Residence on Census Night**

Place of Residence	Persons
Counted at home	7,334
Visitor from Same LGA	142
Visitor from New South Wales	575
Visitor from Victoria	121
Visitor from Queensland	80
Visitor from South Australia	10
Visitor from Western Australia	3
Visitor from Tasmania	6
Visitor from Australian Capital Territory	12
Overseas visitors	31

Note: Data from the Australian Bureau of Statistics 2001 Census.

Further information on social and economic aspects is provided in *Section 6.11*.

## 4.3 Legislation

The key legislation concerning opal mining and this REF are the *Mining Act 1992* and the *Environmental Planning and Assessment Act 1979*. These are discussed in *Section 1.4*. Below is a discussion of other legislation relevant to opal mining.

### 4.3.1 Commonwealth Legislation and Agreements

#### ***Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)***

This EPBC Act affects developments that have the potential to impact areas that are defined by the Act as “matters of national environmental significance”. The seven matters of national environmental significance identified in the Act as triggers for the Commonwealth assessment and approval regime are:

- World Heritage properties;
- National Heritage places;
- Ramsar wetlands of international significance;
- nationally listed threatened species and ecological communities;
- listed migratory species (as listed under the China Australia Migratory Bird Agreement and the Japan Australia Migratory Bird Agreement);
- Commonwealth marine areas; and
- nuclear actions (including uranium mining).

The EPBC Act represents a framework in which Australia’s obligations under a number of international agreements such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Ramsar convention.

The EPBC Act provides that certain actions, in particular those which are likely to have a significant impact on a matter of national environmental significance, are subject to a rigorous assessment and approvals process. In order to determine if a proposal is likely to impact on matters of national environmental significance a referral must be made to the Department of Environment and Heritage. A referral is a set of information that includes contact details and brief descriptions of the proposal, its location and potential impacts on matters of national environmental significance. The purpose of the referral stage is to determine whether a proposed action requires approval under the *Environment Protection and Biodiversity Conservation Act 1999*. If the Minister determines that an approval is required, the proposed action will proceed through the assessment and approval process.

Under Section 524 of the *Environment Protection and Biodiversity Conservation Act 1999* it states that a decision by a government body to grant a governmental authorisation (however described) for another person to take an action is not an action. This means that the Department of Mineral Resources is not the proponent of opal

mining at Lightning Ridge and that individual miners would be responsible for submitting a referral related to individual actions. While Section 69 states that a State agency that is aware of a proposal by a person to take an action may refer the proposal to the Commonwealth Minister for a decision whether or not the action is a controlled action, if the State agency has administrative responsibilities relating to the action this would only apply once a specific action has been proposed.

In relation to prospecting and exploratory drilling activities, the Administrative Guidelines on Significance indicate that such activities would not be expected to have a significant impact on a matter of national environmental significance where the discharges, emissions and waste from the drilling are contained and managed in an environmentally sensitive manner. Underground mining activities however may have a significant impact on matters of national environmental significance.

Issues relating to threatened and migratory species are dealt with in *Section 6.3*, while national heritage places are dealt with in *Section 6.4*.

The flora and fauna assessment has suggested there is likely to be a significant impact on threatened species of animal listed under the *Environment Protection and Biodiversity Conservation Act 1999* and as such a series of further studies and the implementation of mitigation measures is recommended so that significant impacts can be avoided and the need for individual referrals at the stage of a mineral claim would not be necessary.

### ***Native Title Act 1993 and Native Title Amendment Act 1998***

The *Native Title Act 1993* aims to provide for the recognition and protection of native title and establish ways in which future dealings affecting native title can proceed. It established a mechanism for determining claims to native title and established that Native Title could not be extinguished contrary to the Act.

The *Native Title Amendment Act 1998* is an Act to amend certain provisions of the *Native Title Act 1993*. Section 26C of the Native Title Amendment Act allows for a State Minister to apply to the Commonwealth Minister to determine in writing that a specified area of land or waters within a particular State or Territory is an approved opal or gem mining area. In effect this protects the rights of opal miners from Native Title claims. The Act sets upper limits on the size of opal prospecting block at 500 hectares and duration of five years. The NSW *Mining Act 1992* has been amended to reflect these values.

In 1999 the New South Wales Minister for Land and Water Conservation requested that the Commonwealth Attorney General determine under Section 26C of the Native Title Act land as “approved opal or gem mining areas” at Lightning Ridge. The initial request was in relation to the entire areas covered by the Narran-Warrambool Reserve. However, a subsequent request identified two areas (Area 1 and 2) that covered the Reserve but that were bounded by the ridgeline.

A search of the National Native Title Tribunal (NNTT) identified five Indigenous groups active within the Walgett Shire Council local government area. Two groups, the Hall Murray Clan of the Euahlayi People (NNTT number NC97/11) and the Nyoongah Ghurradong Murri (Granny Ethel) Euaylay-i People (NNTT number NC96/26) are registered claimants. The three remaining groups are unregistered claimants, either in the process of being tested for registration or at pre notification stage of the Native Title claim process. The Kooma People #3 (NNTT QC02/16) are currently identified for registration testing, whilst the Nyoongar Ghurree – Bhurrah (Gubboothar) Far Western Gumilaroi Aboriginal People and the Gan Bruce are at the pre notification stage.

### **4.3.2 State Legislation**

#### ***Western Lands Act 1901 and Western Lands Amendment Act 2002***

The *Western Lands Act 1901* is the primary piece of legislation for the management of the Western Division of New South Wales. The Western Division represents some two-fifths (42 percent) of the total land area of the State. Apart from a small percentage of freehold land, it is Crown land held under lease, license or reserve.

The objects of this Act are to:

- establish an appropriate system of land tenure for the Western Division;
- regulate the manner in which land in the Western Division may be dealt with;
- provide for the establishment of a formal access network, by means of roads and rights of way, in the Western Division;
- establish the rights and responsibilities of lessees and other persons with respect to the use of land in the Western Division;
- ensure that land in the Western Division is used in accordance with the principles of ecologically sustainable development referred to in section 6 (2) of the *Protection of the Environment Administration Act 1991*;
- promote the social, economic and environmental interests of the Western Division; and
- make other provision for the effective integration of land administration and natural resource management in the Western Division.

The *Western Lands Amendment Act 2002* was a significant update of the initial legislation. It provides for:

- resolving access by developing a public legal road network and easements to rural landholdings;
- establishing a new rental system for Western Lands Leases;
- establishing a broadly-based Western Lands Advisory Council;
- providing opportunities to convert agriculture and similar leases to freehold; and

- improving flexibility in tenure and lease transaction arrangements, including sub-leasing, agistment and issuing licences on leases.

Generally land that is open for opal prospecting licence and mineral claims is currently under leases enacted under the Western Lands Act for grazing purposes. Existing opportunities for access by miners as contained in the *Mining Act 1992* are not be affected by the amendments to the Western Lands Act.

### ***Protection of Environment Operations Act 1997 (PEO Act)***

The *Protection of the Environment Operations Act 1997* is the principal legislation for regulation of activities that have the potential to pollute the environment. The PEO Act provides for a single integrated licence for activities impacting on air, water and noise pollution and waste management with a single integrated licence. The PEO Act has three main objects:

- to protect, restore and enhance the quality of the environment within New South Wales;
- to ensure increased opportunities for public involvement and access to information; and
- to reduce risks to human health and prevent degradation of the environment.

Activities requiring licensing are listed under Schedule 1 of the Act. The relevant definition for mining includes:

*“Mines that mine, process or handle minerals (being minerals within the meaning of the Mining Act 1992 other than coal) and that have disturbed, are disturbing or will disturb a total surface area of more than 4 hectares of land associated with a mining lease or mineral claim or subject to a section 8 notice under the Mining Act 1992 by:*

- (1) clearing or excavating, or*
- (2) constructing dams, ponds, drains, roads, railways or conveyors, or*
- (3) storing or depositing overburden, ore or its products or tailings.”*

As the majority of opal mining is carried out on claims less than 50 metres by 50 metres (0.25 hectares), licensing under the *Protection of the Environment Operations Act 1997* is generally not required for opal mining operations. However, facilities such as wet puddling operations or mullock dumps may require licensing. When a licence under the *Protection of the Environment Operations Act 1997* is required then the Department of Environment and Conservation is the regulatory authority. Walgett Shire Council is generally the regulatory authority for pollution relating to opal mining activities that do not require a licence under the Act.

The Act also provides for the issuing of three types of environment protection notices: clean-up, prevention and prohibition notices.

Clean-up notices can be issued to deal with pollution incidents (for example, a spill of pollutants). Prevention notices can be issued where an activity is being carried out in an environmentally unsatisfactory manner. Clean-up and prevention notices are issued by the regulatory authority for the activity or premises concerned. In emergencies, the Department of Environment and Conservation can issue a clean-up notice even though it is not the regulatory authority in the circumstances. A prohibition notice requires an activity to be stopped and can only be issued by the Minister for the Environment.

Prosecutions, fines and imprisonment under the PEO Act are issued under a three tier system depending on the intent and seriousness of the offence. Tier one offences relate to major environmental pollution and includes wilfully or negligently disposing of wastes. For individuals, fines of up to \$250,000 and imprisonment of up to seven years can be imposed for tier one offences. Tier two offences are all other offences under the Act including carrying out works without the appropriate licences. Offences dealt with via on-the-spot fines are considered to be tier three offence. Tier two offences can attract individual fines of up to \$120,000, while tier three offences can attract a maximum fine of \$750.

### **NSW Heritage Act 1977**

The NSW *Heritage Act 1977* (amended 1999) is the primary piece of legislation affording protection to all historic heritage in NSW. The aim of the Act is to conserve the 'environmental heritage' of the state which includes items such as buildings, works, relics moveable objects or precincts significant for their historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value. Under the Act a 'Place' is defined as an area of land, with or without improvements and a 'Relic' is defined as any deposit, object or material evidence:

- which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement; and
- which is 50 or more years old.

In addition, Section 170 of the Act requires that culturally significant items or places managed or owned by government agencies be listed on the departmental Conservation and Heritage Registers.

There are currently no items listed on the NSW State Heritage Register within the Narran-Warrambool Reserve.

### **National Parks and Wildlife Act 1974**

The *National Parks and Wildlife Act 1974* is administered by the Department of Environment and Conservation (including National Parks and Wildlife Service). It contains provisions that relate to the protection of native terrestrial fauna and some flora. Under the *National Parks and Wildlife Act 1974* it is an offence to take or pick protected flora and harm protected fauna. It is important to note that all threatened fauna are also protected fauna. However, not all threatened flora are protected. Harming of protected flora and fauna is allowed if the activity is carried out by a determining authority within the meaning of Part 5 of the *Environmental Planning and Assessment Act 1979* and the

determining authority has complied with the environmental assessment provisions under Part 5.

All Aboriginal relics are protected under Section 90 of the *National Parks and Wildlife Act 1974*. Sites of traditional significance that do not necessarily contain archaeological materials may be gazetted as Aboriginal places and are protected under Section 84 of the Act. This protection applies to all sites regardless of their significance or land tenure. Under Section 90 of the Act it is an offence to knowingly disturb, damage or destroy relics or Aboriginal places without prior written consent of the Director-General of the Department of Environment and Conservation. Under the Act, a relic is defined as: any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains. A site register search of the NSW National Parks and Wildlife Service Aboriginal Heritage Information Management System identified 124 registered Aboriginal sites within the Narran-Warrambool Reserve.

### ***Threatened Species Conservation Act 1995 and Threatened Species Conservation Amendment Act 2002***

The *Threatened Species Conservation Act 1995* requires that any threatened plant or animal species, populations or ecological communities associated with a proposed development be identified and that acceptable recovery and management strategies be implemented, if a proposal is considered to have a likely significant impact.

The Act requires that a Species Impact Statement (SIS) be prepared if it is determined under Section 5A of the *Environmental Planning and Assessment Act 1979* (the eight part test) that there is likely to be a significant impact on a threatened species, population or ecological community.

The *Threatened Species Conservation Amendment Act 2002* builds on the mechanisms for conserving threatened species, populations and ecological communities, and their habitats established by the *Threatened Species Conservation Act 1995*. Of importance to the current assessment the *Threatened Species Conservation Amendment Act 2002* modifies the test applied to determine significance of impacts. The new tests are likely to be put in place in 2004, although there are saving provisions included in the Act.

The impacts of the proposal on flora and fauna are discussed in *Section 6.3*.

Eight part test were applied to the Five-clawed skink, Bush Thick-Knee, Pink Cockatoo, Red-tailed Black Cockatoo, Hooded Robin, Black-chinned Honeyeater, Barking Owl, Koala, Superb Parrot, Grey-Crowned Babbler and Diamond Firetail. The assessments indicated that continued opal mining in its current form, is likely to result in a significant impact on these species through the loss and modification of habitat. As a result of these assessments, it has been recommended that further assessment is undertaken within OPA 4, to the level of a Species Impact Statement, in order to better understand the likely impacts on flora and fauna (see *Section 7.2.2*).

The general requirements of a Species Impact Statement are covered under Part 6, Division 2 of the *Threatened Species Conservation Act 1995*, with specific requirements

issued by the Director-General Environment and Conservation. A Species Impact Statement usually involves detailed studies of the distribution of threatened species, population and communities and a full assessment of the likely impacts of the proposed action.

### ***Rural Fires Act 1997 and Rural Fires and Environmental Assessment Legislation Amendment Act 2002***

The *Rural Fires Act 1997* and associated *Rural Fires Regulations 2002* cover legal matters relating to bushfires and controlled burning in NSW. On 1 August 2002, the *Rural Fires and Environmental Assessment Legislation Amendment Act 2002* commenced. This Act amends both the *Environmental Planning and Assessment Act 1979* and the *Rural Fires Act 1997* to provide a more streamlined system for planning for bushfire protection.

The changes affect public authorities currently required to prepare Bush Fire Risk Management Plans under the *Rural Fires Act 1997*. The changes cover hazard reduction activities as well as planning and development control matters on land that is identified as being prone to bushfire.

Under the Act it is the duty of the owner or occupier of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land. Under the Act, the holder of a mining lease as defined under the *Mining Act 1992* is the owner of the land and is therefore responsible for undertaking the necessary management measures to prevent the occurrence of bushfires.

## **4.4 Current Planning Controls**

The relevant local environmental planning instrument for the Walgett Shire Council is Interim Development Order No. 1, gazetted on 20 September 1968. It is expected that a Local Environmental Plan, to be prepared under the *Environmental Planning and Assessment Act 1979*, will be finalised within the next couple of years. Until the new Local Environmental Plan comes into force, the provisions of Interim Development Order No. 1 of 1968 apply to the Shire. Brewarrina Shire Council operates under the Brewarrina Local Environmental Plan 2000.

Opal mining and prospecting operations within the Narran-Warrambool reserve are not subject to the Walgett Interim Development Order No. 1 of 1968 or the Brewarrina Local Environmental Plan 2000, but do require environmental assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* (refer Section 1.4).

The Department of Mineral Resources has declared certain parts of the opal fields in Lightning Ridge as “preserved fields”. In these “preserved fields” miners’ camps are permitted, provided the miner holds a mineral claim. The holder of the mineral claim who wishes to establish a camp is required to apply for residential status in respect to that claim. The approval of the Mining Registrar from the Department of Mineral Resources, Lightning Ridge Office, is required for a miners’ camp.

In the “non-preserved fields” no new miners’ camps or extensions to existing camps are permitted (Walgett Shire Council, 1998). The Department of Mineral Resources does however permit maintenance activities to be carried out on existing miners’ camps.

The 1(a) – Non-Urban Zone, relates to the majority of the “preserved fields”. In this zone, a miners’ camp (or dwelling) may be exempt development or be complying development (requiring a Complying Development Certificate) in accordance with the requirements of State Environmental Planning Policy No. 60 – Exempt and Complying Development and the *Environmental Planning and Assessment Act 1979*. A miners’ camp may also be erected in a “preserved field” without requiring a Complying Development Certificate if the camp complies with the following criteria listed in the Walgett Shire Local Approval Policy 1996, and also the criteria listed in Table 5 of the Policy:

- is single storey;
- is not more than 120 square metres (including verandas);
- is on a site which is a mineral claim given residential status by the Mining Registrar;
- will be the only residence on the claim;
- is constructed in accordance with the Building Code of Australia (BCA) and requirements set out in building guidelines issued by the Council; and
- is not compromised of brick, stone, masonry or concrete above floor or ground surface level.

Under the Walgett Shire Local Approval Policy 1996 Council must be notified when a miners’ camp commences occupation, or when building of the camp is finished. The Walgett Shire Local Approval Policy 1996 is still applied to the “preserved fields” pending it being superseded by a similar Development Control Plan that would be developed in conjunction with a Local Environmental Plan.

The miners’ camps in the “preserved fields” are levied minimal rates by Walgett Shire Council. The rate reflects the minimal services and utilities provided at these camps.

## **4.5 Other Acts and Policies**

Other Acts and policies that have been considered, but which are not applicable to opal mining activities include:

- *Water Management Act 2000* and *Rivers and Foreshores Improvement Act 1848*. Section 3A of the *Rivers and Foreshores Improvement Act 1948* does not apply to the exercise of any rights lawfully exercisable under any lease, licence, permit or other right in force under any Act relating to mining;
- *Soil Conservation Act 1938*. This Act is the domain of the Commissioner of Western Lands to direct soil conservation works including mining rehabilitation works where considered necessary. Under the *Mining Act 1992*, a mineral claim cannot be granted over land that is subject to soil conservation works;

- *Native Vegetation Conservation Act 1997* and *Native Vegetation Act 2003*. Under Division 4 of the *Native Vegetation Act 2003*, any clearing of native vegetation that is allowed under the *Mining Act 1992* will not be subject to the *Native Vegetation Act 2003*. However, it is assumed that clearing allowed under the Mining Act has been fully assessed as to its impacts on native vegetation; and
- State Environmental Planning Policy 44 – Koala Habitat Protection. This policy applies only to land under which a development application has been made.



## **5. Stakeholder and Authority Issues**

### **5.1 Consultation Process**

Consultation with key stakeholders was undertaken by members of the project team in conjunction with the Department of Mineral Resources staff. The major objectives of the consultation were to obtain information and identify issues with current opal mining operations that need to be addressed in this REF.

Key stakeholders consulted included:

- Department of Infrastructure Planning and Natural Resources;
- Dhariwaa Elders Group;
- Grawin Glengarry Sheepyards Miner's Association;
- Lightning Ridge Local Aboriginal Land Council;
- Lightning Ridge Miner's Association;
- Lightning Ridge Tourist Association;
- Murdi Pakki Aboriginal Council;
- National Parks and Wildlife Service;
- Pastoralists;
- Walgett Local Aboriginal Land Council; and
- Walgett Shire Council.

Consultation activities conducted included:

- meeting with Department of Infrastructure Planning and Natural Resources in Dubbo on 11 August 2003;
- meeting with Lightning Ridge Miner's Association held at their offices on 14 August 2003;
- a two hour stakeholder workshop held at the Lightning Ridge Bowling Club on 14 August 2003;
- site visit and consultation field day with the Dhariwaa Elders Group and Walgett Local Aboriginal Land Council on 25 September 2003;
- meeting with local farmers at Leon Cravino's property on 28 October 2003;
- meeting with Lightning Ridge Local Aboriginal Land Council held at their offices in Lightning Ridge on 15 December 2003; and

- telephone discussions with officers from Department of Environment and Conservation, Commonwealth Department of Environment and Heritage and Walgett Shire Council.

Stakeholder issues raised at these meeting are discussed below. Meeting minutes from the stakeholder workshop and meeting with local farmers are included in *Appendix C*.

## **5.2 Stakeholder Issues**

### **5.2.1 Mining Issues**

Mining issues raised at the meeting with the Lightning Ridge Miner's association are listed below:

- the REF should address the socio-economic impacts of mining regarding OPA 4 including Walgett;
- poor condition of roads during wet weather in mining areas;
- Lightning Ridge Miners Association is lobbying for an environmental levy to be applied to each claim to allow for rehabilitation;
- concern that proposed one hectare claims in OPA 4 may push out smaller operators;
- the ability to obtain a mineral claim 'over the counter' is an important part of the culture;
- collapse in the overseas tourism industry, particularly from Asia, has led to a reduction in opal prices;
- other states look to Lightning Ridge for guidance on opal mining industry standards;
- local and state government assistance is low because of low official population compared to Walgett – most miners are not counted in Australian Bureau of Statistics figures;
- the majority of farmers are miners too; and
- most women work in service industries including tourism.

### **5.2.2 Farming Issues**

Issues/comments raised at the stakeholder workshop and meeting at Leon Cravino's property are listed below:

- farmers are not generally anti-mining;
- loss of access for farmers in the vicinity of mining areas is of concern;
- property impacts including loss of fences and gates, track management/maintenance, excessive vegetation clearance and dog attack;

- concern over impact of mining on black soil areas;
- lack of enforcement of property agreements;
- camps on claims – lack of sanitation and inadequate services;
- the mining potential of OPAs 1 to 3 should be exhausted before OPA 4 is opened up;
- farmers are not opposed to mining within OPA 4 provided it is properly controlled;
- lack of consultation in relation to siting of mullock dumps;
- impacts from mullock dumps including visual impact, reduction in grazing area, and impacts from fine particulates;
- compensation paid by miners to farmers is inadequate;
- rehabilitation is not undertaken or fully completed in many instances. The penalties and enforcement are inadequate to prevent this practice;
- spread of weeds through mining activities – vehicle movements;
- loss of topsoil in mining areas; and
- an Environmental Impact Statement is required rather than an REF.

### **5.2.3 Aboriginal Groups**

Issues raised at the stakeholder workshop, site visit/consultation field day and the community meeting are listed below:

- the aboriginal community is concerned over the potential for mining near Narran Lake as this is considered a significant area;
- Ted Fields snr has been consulted by the Lightning Ridge Miners Association (LRMA) on a regular basis regarding aboriginal cultural issues in relation to mining areas. LRMA is aware of the dreaming trail along the ridge line and other sensitive cultural sites in the region;
- it was commented that George Rose is the senior elder in relation to this region and is the appropriate person to consult;
- it was suggested that money collected from miners for the Native Title trust be used to mark out the dreaming trail and to protect significant sites rather than being allowed to go back into consolidated revenue;
- the aboriginal community is concerned on the effect on local fauna from clearing mining access roads. Protection for native birds was mentioned as a particular concern;
- miners believe that mining activities have less effect on cultural heritage than grazing activities;
- the elders group is training aboriginal site officers;
- identification of sites is considered important to keep aboriginal culture alive in the region;

- the aboriginal population of Walgett is approximately 1,200;
- a heritage study was conducted by John Watkins through the Department of Mineral Resources in 1983;
- a heritage study has been commissioned through Murdi Pakki – Bourke office of ATSiS. Michael Stewart is conducting this study;
- concern over the proposed opening of OPA 4 for mining activities based on impact of mining activities within OPAs 1-3. It was recognised that OPA 4 is needed for the economic survival of Lightning Ridge;
- support for rehabilitation and revegetation of previously mined areas;
- concern over lack of consultation by the Department of Mineral Resources with aboriginal groups. The Aboriginal community would like to work with the Department of Mineral Resources to assist in the management of their cultural heritage;
- the landscape from Angledool to the Narran Lakes system is a significant dreaming trail;
- there is a wealth of material culture present as individual site features as well as the cultural landscape and the connection between features within that landscape;
- concern over the lack of respect within the mining community for Aboriginal people and the tensions that exist. This tension may make protection and management of Aboriginal cultural heritage values within the opal fields a difficult issue;
- removal of trees without the involvement of Local Aboriginal Land Councils;
- funding should be provided for the recording of oral histories; and
- lack of resources for the Local Aboriginal Land Councils.

#### **5.2.4 Tourism**

- Tourism supports most businesses in town.
- Aside from mining, the key attractions are the lifestyle and people.
- Further attractions are needed such as a working mine tour.
- Many people are also attracted by town facilities such as the swimming centre.

### **5.3 Authority Issues**

#### **5.3.1 Department of Infrastructure Planning and Natural Resources**

The following issues were noted from a meeting with Department of Infrastructure, Planning and Natural Resources representatives held in Dubbo on 11 August 2003:

- the two hectare clearing exemption under the Native Vegetation Conservation Act doesn't generally apply to the western division, but exemption for clearing does exist under the *Mining Act 1992*. Therefore measures to control and assess the impact of clearing should be covered in mineral claim applications;
- trees within the Reserve are Crown timber. State Forests control the harvesting of trees by miners for mine props etc. There is one licensed operator in the area, who also ensures no illegal wood is cut;
- in terms of biodiversity assessment, it should be considered that once the land is cleared for mining it is permanently cleared;
- the reworking of mullock dumps is being considered;
- the spread of the noxious weed, Hudson's Pear, is of concern;
- proposed amendments to the Native Vegetation Conservation Act should be considered in the REF;
- management of tracks in mining areas is an issue. There has been a working group established to look at restricting tracks. The Mining Act doesn't allow access for prospecting;
- the Permissive Occupancy area surrounding Lightning Ridge is formerly part of Lorne Station pastoral lease. A working group has been established to consider how to formalise title for this area. Currently 900 to 1000 camps exist. The likely form of title is a residential lease under the Western Lands Act. Council rates of \$100 per annum currently apply;
- the Department of Mineral Resources proposes that former mining areas would revert back to a grazing lease. This may not be practical due to the presence of mullock dumps and puddling dam sites; and
- water harvesting is an issue on some mining areas.

### **5.3.2 Department of Environment and Conservation - National Parks and Wildlife Service**

Consultation with Department of Environment and Conservation staff in relation to the proposed OPA 4 revealed a number of issues of concern:

- the nature of opal mining results in the disturbance of vegetation in particular the removal of large tracts of ground cover and understorey vegetation leaving large areas of bare soil. During rain periods the subsequent erosion of these areas can cause significant problems;
- the lakes within the Narran Lake Nature Reserve (Clear Lake and Back Lake) and Narran Lake proper are all shallow lakes of depth between one to one and a half metres. Many small catchments (tributaries) exist within OPA 4 that eventually deliver water to these lakes. If opal mining were to be conducted in close vicinity to the lakes any erosion that may occur will enter these tributaries and the eventually the lakes themselves;
- the implementation of a buffer zone around these lakes would be needed; and

- vegetation within OPA 4 is relatively undisturbed and is currently subject primarily to grazing by sheep and to a lesser extent by cattle. The retention of any remnant vegetation within this area is highly desirable.

### **5.3.3 Department of Environment and Heritage**

Consultation was undertaken with the Commonwealth Department of Environment and Heritage with regard to the possible impacts on matters of national environmental significance as listed under the *Environment Protection and Biodiversity Conservation Act 1999* and the need for a referral (see *Section 4.3.1*):

- in general the Department of Environment and Heritage are supportive of the three stage approach proposed for assessing/considering the environmental impacts of the proposed release program (see *Section 7.2.2*) and would appreciate the opportunity to participate in this process;
- Section 524 of the *Environment Protection and Biodiversity Conservation Act 1999* states that "a decision by a government body to grant a governmental authorisation (however described) for another person to take an action is not an action". Therefore the proposed release program by the Department of Mineral Resources (that is, the issuing of government licences/authorisations) is not an action that can be considered under the *Environment Protection and Biodiversity Conservation Act 1999*. That is, the Act applies specifically to projects, developments etc that have a physical interaction with the environment;
- in the view of the Department of Environment and Heritage it would be most appropriate for individual referrals (if required) under the *Environment Protection and Biodiversity Conservation Act 1999* to be submitted at the time that the respective specific mineral claims are being considered by the Department of Mineral Resources; and
- in relation to exploratory drilling activities, the Administrative Guidelines on Significance indicate that such activities would not be expected to have a significant impact on a matter of national environmental significance where the discharges, emissions and waste from the drilling are contained and managed in an environmentally sensitive manner. Possible exceptions could be where such exploration was likely to damage critical habitat for a species or disrupt the breeding cycle of a population of a species, or where exploratory drilling was to occur in or immediately adjacent to a Ramsar wetland.

### **5.3.4 Walgett Shire Council**

Comments from Matthew Goodwin of Walgett Shire Council made at the stakeholder workshop:

- a new Local Environmental Plan is under preparation covering the Lightning Ridge area. The current Local Environmental Plan dates back to 1968. A draft was prepared in 1990 but never gazetted;
- in terms of land use, Council want to see a balance between mining, tourism and farming; and
- there is a possibility of Walgett Shire merging with Brewarrina. Brewarrina has a current Local Environmental Plan.

## **6. Environment Assessment**

### **6.1 Water Management**

#### **6.1.1 Surface Water**

##### ***Existing Environment***

As discussed in *Section 4.1*, the Narran-Warrambool Reserve is located within the north east portion of the Murray-Darling Basin. The principal rivers in this area are the Barwon River, Bokhara River and the Narran River (*Figure 1.1*).

The Barwon River has its source in the New England plateau near to Glen Innes as the Macintyre River and flows initially northwards through Inverell to the Queensland border at Goondiwindi and then westwards as the Barwon River through Mungindi, Collarenebri, Walgett and Brewarrina joining the Darling River approximately 40 kilometres north-east of Bourke.

The Bokhara River is part of the Condamine-Balonne River and is part of an anabranch system that includes the Culgoa and Birrie Rivers. This river system starts as the Condamine River with its source in the Great Dividing Range south of Warwick flowing first north and then west before heading south as the Balonne and splitting into the three anabranches near Dirranbandi approximately 50 kilometres north of the Queensland-New South Wales border. The three anabranches ultimately join the Barwon/Darling River between Bourke and Brewarrina. The Narran River is a terminating branch of the Balonne River, and discharges into Narran Lake.

The Condamine-Balonne system has a catchment area of 143,900 square kilometres which represents 14 percent of the area of the Murray-Darling Basin. The majority of the water in the river system is derived from the well watered highlands of south-east Queensland (Narran Lakes Scoping Study, 2002). The landform is essentially a large floodplain wetland complex.

The eastern boundary of the lower Balonne system within the reserve is formed by the Cretaceous ridge country which is situated approximately 30 metres above the floodplain. Further to the east is a similar floodplain wetland complex associated with a series of ephemeral streams of which The Big Warrambool is the most prominent. This is referred to as the Rotten Plain Land System or colloquially 'Black Soil Country'.

Two other ephemeral lakes, Coocoran Lake and Angledool Lake, exist in the Cretaceous ridge country. The main rivers flow during most seasons, however during the recent drought most were reduced to a series of waterholes either natural or impounded by weirs.

The minor ephemeral watercourses are intermittently flooded by the Narran River and from localised runoff. When flooded, all the lakebeds of the Rotten Plain Land System, except those filled only from local runoff, are connected to each other and the Narran

River. Most lakebeds have flooded two to six times over the last 20 years, generally between January and April, with the duration of inundation ranging from three months to three years.

Surface water is collected for mining and stock watering in dams and is supplemented with bore water. Water sourced from the Great Artesian Basin is used for mining activities near Lightning Ridge. The dams in the Coocoran Field are supplemented by water pumped from the Narran River.

### ***Water Usage by Opal Mining Operations***

Water is used for either domestic purposes or for opal processing – termed ‘wet puddling’.

Domestic water is generally derived from roof rain water tanks to individual dwellings. In some instances this is supplemented by bore water or dams where available. Data in relation to domestic water use is not available, however based on an approximated population of 5,000 people engaged or supported by mining activities outside the main town of Lightning Ridge (based on 1,700 dwellings outside Lightning Ridge and an average of 2.9 persons per household), with an average usage of 100 litres per person per day the annual domestic water consumption can be estimated at approximately 180 megalitres per annum.

It is unclear exactly how many wet puddling operations are operating within the Narran-Warrambool reserve (David Howell, personal communication) since at any one time many licences do not physically operate agitators.

### ***Impact of Existing Mining Operations***

Wet puddling uses four to five kilolitres of water to process one tonne of potentially opal bearing claystone in 10 to 15 minutes. Water is sourced from bores and storage dams and has limited impact on local surface water resources.

A typical wet puddling operation is described in *Section 2.3.3*. Water used for wet puddling operations is returned to the environment. The sediment is contained within the confines of a dam and the remaining water either evaporates or percolates through surface soils back into the ephemeral channel system.

Wastewater from camps is usually grey water, with most dwellings having an outside ‘drop’ toilet. On site disposal of wastewater generally presents few health problems with the low population density and arid environment. Some issues may exist where higher population densities exist such as in the ‘peroc’ area surrounding Lightning Ridge.

The main impact from sediment dams is localised damage to vegetation as discussed in *Section 6.3*. The sediment is not known to contain any contaminants and no chemicals are used in the processing of opal dirt. Some minor hydrocarbon contamination was noted from engine oils, associated with field maintenance of plant and equipment.

### **Potential Impact of Mining Operations within OPA 4**

Potential surface water sources close to potential mining areas within OPA 4 are limited. Because of the sensitivity of Narran Lake and the surrounding wetland system, no extraction of water should be permitted from these sources. As discussed in *Section 6.2* a minimum buffer zone of three kilometres is proposed around Narran Lake and this buffer would also prohibit the establishment of wet puddling operations and mining camps to safeguard water quality.

Outside this buffer, wet puddling operations could be established provided suitable dam locations are available. Grazing properties in this area currently have dams used for stock watering and domestic purposes. Cooperative arrangements could be established with graziers in this area similar to those existing in other part of the reserve. Consultation with graziers in the area should be undertaken on potential water sharing arrangements in this area.

### **Recommended Mitigation Measures**

- New wet puddling sites should provide for return of water from settlement dams to the water supply dams to minimise losses within the operation. This could be achieved by pumping recycled water, after sediments have settled back to the water supply dams using renewable energy sources such as solar, or wind power.
- Waste oil from oil changes to equipment in the field should be collected in a sealed container and transported to the nearest collection point. Currently the nearest collection service is in Walgett, provided by Australian Waste Oil Refineries.
- The establishment of new wet puddling operations should be preceded by consultation with the grazing lease holder to establish cooperative arrangements for the potential shared usage of the water resource.
- No extraction of surface water should occur from the Narran River and associated wetland system within OPA 4.
- No wet puddling operations or mining camps should be permitted within a three kilometre buffer to be established around the boundary of Narran Lake.
- An investigation should be undertaken in relation to wastewater disposal within the 'peroc' to determine whether the current practices are satisfactory from a public health viewpoint.
- Guidelines should be developed for on-site wastewater disposal within mining camp areas. Consideration could be given to the establishment of communal facilities in long term camp areas.

## 6.1.2 Groundwater

### **Existing Environment**

The Lightning Ridge opal fields are located on the south-eastern corner of the Great Artesian Basin. A search of the Department of Infrastructure, Planning and Natural Resources groundwater bore licence register indicated that there are currently 104 bores located within a 60 kilometre diameter region centred 20 kilometres west of Lightning Ridge (*Table 6.1*). The vast majority of these bores access the groundwater resources of the Great Artesian Basin at depths of 500 to 1,000 metres below surface level and are used for stock. A small number of bores extract from shallow groundwater close to river systems at depth of up to 100 metres.

**Table 6.1: Types and Numbers of Bores within the Area of the Lightning Ridge Opal Fields**

<b>Use</b>	<b>Number of Bores</b>
Mining	4
Joint (including mining)	4
Stock	63
Irrigation	3
Domestic	3
Domestic and stock	11
Industrial	1
Public/Municipal	4
General use	1
Oil exploration	1
Unknown	9

The township of Lightning Ridge has an artesian bore as its primary source of water. The use of bore water for mining purposes is limited to one bore on the northern boundary of Lightning Ridge and five privately owned bores in the Coocoran field. All but one of these bores (located in the Coocoran) access artesian groundwater.

### **Impacts of Existing Mining Operations**

Of the total volume of groundwater abstracted in the region one percent is used for mining purposes. Town water supply accounts for five percent, with the remaining 94 percent for stock and domestic use (Department of Mineral Resources, 2003). Data on water consumption is limited, but is available for Emu's Bore which was turned on in 1997. This bore services four processing tanks and approximately 88 sites. Consumption varies from year to year but is in part related to the number of agitators operating and the rainfall (*Table 6.2*). The utilisation of groundwater resources for mining purposes is relatively limited and is unlikely to be having a significant effect on groundwater resources within the Great Artesian Basin.

**Table 6.2: Bore Consumption for Emu's Bore Located within the Cooncooran Fields**

<b>Year</b>	<b>Bore Water Consumption Used Per Year (Megalitres)</b>	<b>Average Number of Agitators Working Per Week</b>	<b>Rainfall Per Year (millimetres)</b>
1997	81.03	33.15	235.3
1998	27.02	15.93	615.6
1999	25.17	25.15	670.5
2000	46	24.34	552.8
2001	49.6	19.85	244.55
2002	173.33	16.4	76.25

Note: Data supplied by the Lightning Ridge Miners Association.

### ***Potential Impact of Mining Operations within OPA 4***

Based on current usage of groundwater resources within OPAs 1-3, the future opening of OPA 4 is unlikely to have a significant impact on groundwater resources.

### ***Recommended Mitigation Measures***

In order to provide for sustainable use of this valuable resource, it is recommended that bores be inspected regularly to ensure that they are in good working order and no leakage or wastage of water is occurring. Any unused or abandoned bores should be capped.

## **6.2 Geology and Soils**

### ***Existing Environment***

Lightning Ridge lies in the Surat Basin, which is part of the Great Australian Basin covering 1.7 million square kilometres of eastern Australia. Opal is found in the deeply weathered portion of the Early Cretaceous Graman Creek Formation. Overlaying these sedimentary rocks are sandstones and conglomerates of the Tertiary Period which have often hardened to form silcrete.

Opal bearing sedimentary rocks are generally found at depths between 6 and 18 metres from the surface. Opal is present in one of two forms – either in seams or as nobbies. Nobby opal refers to opal that is a naturally occurring, lump-shaped piece of opal and seam opal refers to a horizontal layer of opal found in the ground. Nobby opal is more common in the area surrounding Lightning Ridge, the Coorcoran and to the north. Seam opal is more common in the south around the Grawin fields.

There are two theories relating to the origin of Opal deposits. The “Deep Weathering” theory involves the precipitation of amorphous silica (opal) over a long period of time from downward moving groundwater. This would have occurred during a higher rainfall climate than currently exists. The more recently proposed “Syntectonic” theory proposes that the opal was deposited rapidly by groundwater saturated by amorphous

silica coinciding with tectonic activity. In this theory the groundwater is forced by heat and pressure along faults and fractures (Department of Mineral Resources, 1984).

The Graman Creek formation weathers to produce soils of what is termed the Lightning Ridge Land System (ridge country) which are shallow to moderately deep red earths (Kandosols) and scattered sands and Lithosols on top of siltstone and sandstone. The red earths are relatively permeable and moderately susceptible to erosion, with sandy areas less so. Red earths are generally highly weathered and have low fertility although they have good physical properties for pasture growth when rainfall occurs. Traffic movement after periods of rain can lead to compaction and loss of organic content of the soil (from reduced vegetation cover) can cause hard-setting. The carrying capacities of these Land Systems are generally between five and eight head per unit area (Department of Conservation and Land Management, 1993).

The floodplains comprise Quaternary aged sediments which can be divided into two main Land Systems – the Rotten Plain and Llanillo Land Systems. Soils of the Rotten Plain Land System are generally deep grey cracking clays (grey Vertosols) with minor non-cracking clays where very limited erosion occurs and Gilgai formation is common. Floodplain soils of the Llanillo Land System can be grey cracking and non-cracking clays or brown texture-contrast soil where minor to moderate scalding can occur. The carrying capacity of these Land Systems for sheep is generally between two and five hectares per head on the ridge areas and roughly 1.4 hectares per head on the black soils (Lightning Ridge Miners' Association 2004).

### ***Impact of Existing Mining Operations***

The principal impacts on soils associated with opal mining operations are related to erosion, compaction and subsidence.

Erosion typically occurs where vegetation has been removed and mining activities have led to a concentration of surface water flows. Examples include:

- gully erosion along roads and tracks where appropriate drainage has not been provided;
- gully erosion adjacent to wet puddling operations where surface water flows have become concentrated;
- rill or sheet erosion on embankments associated with wet puddling operations or mullock dumps; and
- erosion on the surface of sediment dams.

Typically these erosional features are limited in scale and localised to the immediate area of disturbance. Remedial measures are needed, however, because of the slow natural recovery of these areas with low soil fertility and often the removal of topsoil, and susceptibility of the soils to erosion.

Mullock is particularly susceptible to erosion in the longer term as it contains minimal organic matter that would facilitate natural rehabilitation. Mullock dumps have been encouraged by the Department of Mineral Resources as a means of localising visual and other impacts associated with Mullock disposal. These facilities are in general well

managed with minimal erosion observed to be occurring. Bunds are created around mullock dumps and wet pudding areas to minimise runoff and erosion. However, mullock is highly dispersible (thus increasing the turbidity of runoff) and can be moderately saline. Pondered water/fines from puddling operations can kill vegetation where salinity levels are high.

Mullock is also a concern to some graziers who claim that the material may be contaminated. Some limited testing of this material has been carried out. Eight samples of mullock were tested by the Scone Research Service Centre - Soil Services, Department of Land and Water Conservation (1999). The testing included:

- particle size analysis;
- dispersibility;
- conductivity – a measure of salinity;
- pH;
- total nitrogen and phosphorus – a measure of nutrient level; and
- exchangeable cations – trace elements including sodium, potassium, calcium, magnesium and aluminium.

The tests showed that the mullock is somewhat variable in properties. Nutrient availability is typically low, dispersibility was moderate to high, and high levels of salinity were found in four out of the eight samples. Two out of the eight samples had moderately low pH (levels of 4.9 and 5.0). No specific testing for contaminants such as heavy metals was carried out. However, given the mineralisation processes of substrate materials it is considered unlikely that mullock materials contain other contaminants such as heavy metals, or if present they are unlikely to be bioavailable.

Compaction occurs along roads and in camp site and mining areas where heavy vehicles are used. The repeated vehicle movements compact the soil surface over time and inhibit natural rehabilitation of such areas. A typical example of a former camp site affected by compaction is shown in *Photograph 6.1*. Again, these areas although localised require active remediation to re-establish vegetation following the cessation of mining activities.

Subsidence is an increasing common feature of areas where mining has ceased (*Photograph 6.2*). In areas affected by subsidence the ground surface may be lowered locally by up to three metres. This subsidence is not uniform in nature and causes significant disturbance of vegetation and localised erosion. There is some support in the mining community to allow open cut operations to occur on subsided areas so that these areas can be reworked and ultimately rehabilitated.



Photograph Credit: Hugh Swinbourne

**Photograph 6.1: Soil Compaction Resulting from Mining Activities**



Photograph Credit: Hugh Swinbourne

**Photograph 6.2: Subsidence in a Mining Area**

### ***Potential Impacts from Mining in OPA 4***

Similar impacts would be expected to occur within OPA 4 as the soils are of the same type. Impacts to the sensitive Narran Lakes catchment should be avoided and a proposed three kilometre buffer around the lake should prevent sediment mobilised by mining activity from reaching the lake. Improved management of mining operations is recommended to avoid some of the impacts noted above and to reduce the intensity of other impacts. These measures are outlined below.

### **Recommended Mitigation Measures**

- Site specific erosion and sedimentation control plans (ESCP) should be developed for intensive areas of activity including wet puddling areas, mullock dumps and open cut mines. Typical measures to be incorporated in each ESCP include:
  - ▶ minimising the area of disturbance and vegetation removal;
  - ▶ designing drainage to prevent concentrations of flows;
  - ▶ providing silt fences to protect sensitive areas including natural waterways and lakes; and
  - ▶ rehabilitate areas following use in accordance with guidelines provided in *Appendix B*.
- For existing mining areas, review the existing network of roads and tracks and close unnecessary roads. This should be done in consultation with the Lightning Ridge Miners Association, the Glengarry, Grawin, Sheeppyard Miners Association and mineral claims holders and grazing leaseholders. Closed roads or tracks should be rehabilitated appropriately.
- Carefully plan access roads and tracks to new mining areas and provide formalised drainage to minimise erosion risk and control sedimentation.
- Construction of roads or access tracks should require the approval of the Department of Mineral Resources as part of the granting of a mining lease or exploration permit.
- Vehicular movement during extended wet weather should be discouraged as hard setting of soils can occur exacerbating compaction.
- For new mining areas, including OPA 4, designated camp sites should be developed by agreement between Lightning Ridge Miners Association and the Department of Mineral Resources and a charging system developed for their use. The establishment of any new camp sites should require a separate approval and environmental assessment. Fees should be charged for the use of these areas to provide for their upkeep, provide services and ultimately provide for rehabilitation.
- The open cutting of subsided areas should be encouraged where environmentally appropriate as a means of encouraging ongoing mining activity ultimately rehabilitating the mined landscape.
- Areas of subsidence which are not suitable for open cutting should be stabilised and rehabilitated. Areas where subsidence is active should be monitored on an ongoing basis.
- Materials stockpiles should be sites away from areas of concentrated water flows and include minimal amounts of topsoil or vegetation.

## **6.3 Flora and Fauna**

A flora and fauna assessment was undertaken of the Narran-Warrambool Reserve, Lightning Ridge by the Johnstone Centre, Charles Sturt University, including field

investigations undertaken on 12 to 15 August 2003. The report is attached in *Appendix D*. Outcomes of the assessment are summarised below.

### **Existing Environment**

There are four main types of vegetation communities scattered throughout the Narran-Warrambool Reserve with some communities intergrading into others. The four main types are Bimble Box (*Eucalyptus populnea*)/White Cypress Pine (*Callitris glaucophylla*) Woodland, Coolibah (*Eucalyptus coolabah*), Black Box (*Eucalyptus largiflorens*) with some River Red Gum (*Eucalyptus camaldulensis*) and native grasslands. The majority of opal mining occurs in the Bimble Box/White Cypress Pine Woodland. A general vegetation map is presented in *Figure 6.1*.

Within the Darling Riverine Plains Bioregion, the Narran-Lightning Ridge subregion consists predominantly of this type of vegetation. Other Bimble Box communities occur in only three other subregions (Castlereagh-Barwon, Collarenebri Interfluvium and Wilcannia Plains) in small pockets, but the majority of Bimble Box on red soil ridges occur in the Narran-Lightning Ridge subregion. From a bioregional perspective it is important that Bimble Box communities on red earth soils within this subregion are conserved, as they are less common in other areas across the bioregion.

Dominant canopy species present within the opal mining areas of the Narran-Warrambool Reserve include Bimble Box/White Cypress Pine and scatterings of Silver-leaved Ironbark (*E. melanophloia*). The understorey within opal mining areas is generally scant, but where present consists of Budda (*Eremophila duttonii*), Boobialla (*Myoporum montanum*), Leopardwood (*Flindersia maculosa*), Wild Orange (*Capparis mitchellii*), Warrior Bush (*Apophyllum anomalum*), with the predominant species being Emu Bush (*Eremophila mitchellii*) and Old Man Saltbush (*Atriplex nummularia*). Old Man Saltbush is likely to occur in mining areas as a result of planting (D. Howell, *personal communication*). Common ground cover species found during the surveys include Blue Crowfoot (*Erodium crinitum*), Bogan Flea (*Calotis cuneifolia*) and Goathead Burr (*Sclerolaena bicornis*).

No threatened species of plant were identified during the surveys. There are ten threatened species that have historical records in the Walgett local government area or are known to occur in the region covered by the Draft Walgett Regional Vegetation Management Plan. None of these ten species were encountered during surveys. Currently, there are no endangered ecological communities within the Narran-Warrambool Reserve listed under either the *Threatened Species Conservation Act 1995* or the *Environment Protection and Biodiversity Conservation Act 1999*.

Birds were the most common fauna group observed with 43 species recorded during the survey. Five species of mammal were also identified including the Eastern Grey Kangaroo (*Macropus giganteus*) and the Red Kangaroo (*Macropus rufus*). Three threatened species of animal, Grey-crowned Babbler (*Pomatostomus temporalis*), Superb Parrot (*Polytelis swainsonii*) and Pink Cockatoo (*Cacatua leadbeateri*) were recorded during the survey period (12 to 15 August). Only the Grey-crowned Babbler was recorded within the boundaries of the four Opal Prospecting Areas while the remaining two species were recorded on the fringes of the survey areas.

**Figure 6.1: General Vegetation Types within the Narran-Warrambool Reserve**



Quality of faunal habitat ranged from low to high across the Narran-Warrambool Reserve. Areas of low habitat value occur predominantly in mining areas and associated access areas with corridors of higher quality vegetation in between. Areas of high quality habitat contained a continuous canopy of vegetation, understorey and diverse ground cover, fallen branches, logs and leaf litter. Low quality habitat areas generally lacked a diverse ground cover (monocultures of Buffel Grass were observed in some low value habitat mining areas), lacked woody debris, and had a fragmented overstorey of canopy and understorey vegetation. Low value habitat areas also included compacted soil that has resulted in a loss of habitat for some reptiles and small mammals.

To compensate for a brief survey period and the seasonal movements of many locally threatened species, searches of Threatened Species of Western New South Wales and National Parks and Wildlife Service Atlas of New South Wales Wildlife databases were conducted. These identified forty-six species of endangered or vulnerable plants and animals whose ranges extend over the opal prospecting areas.

The south-western boundary of OPA 4 is located adjacent to Narran Lake Nature Reserve (*Figure 1.1*) which is listed as a Ramsar wetland and as such is protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Narran Lake Nature Reserve covers part of a large terminal wetland of the Narran River and is internationally significant for waterbird breeding and as habitat for species including a number listed under the Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA and CAMBA). The Nature Reserve also contains a variety of flora associations which are considered to be threatened in New South Wales. Narran Lake Nature Reserve was included as a Ramsar wetland based on three criteria (taken from the NSW National Parks and Wildlife Service recommendation to list Narran Lakes Reserve as a Ramsar Wetland):

- Narran Lake Nature Reserve is a particularly good representative example of a natural or near-natural wetland characteristic of the Darling Riverine Plains biogeographical region. Narran Lakes contain a considerable diversity of habitats including some of the largest expanses of Lignum (*Muehlenbeckia florulenta*) in New South Wales and are wetlands that are geomorphologically significant as an excellent example of a relatively undisturbed terminal lake system;
- Narran Lake Nature Reserve is of special value as habitat of plants or animals at a critical stage of their biological life cycle. Waterfowl that have been recorded breeding in Narran Lake Nature Reserve and which are considered to have a restricted breeding distribution in Western New South Wales include: Australian Pelican (*Pelecanus conspicillatus*), Great Cormorant (*Phalacrocorax carbo*), Pied Cormorant (*Phalacrocorax varius*), Darter (*Anhinga melanogaster*), Rufous Night Heron (*Nycticorax caledonicus*), Large Egret (*Ardea alba*), Little Egret (*Ardea gazetta*), Intermediate Egret (*Ardea intermedia*), Glossy Ibis (*Plegadis falcinellus*), Australian White (Sacred) Ibis (*Threskiornis molucca*), Straw-necked Ibis (*Threskiornis spinicollis*), Great Crested Grebe (*Podiceps cristatus*), Royal Spoonbill (*Platalea regia*), Gull-billed Tern (*Sterna nilotica*). Narran Lakes are considered to be nationally and internationally significant as they are the major breeding site for the above species of waterbirds and many other species. During the 1994-96 Murray-Darling Basin Water Monitoring Project run by Birds Australia, the Narran

wetlands were among the highest ranked sites for species richness, number of breeding species and total number of birds. Narran Lake Nature Reserve also supports a number of internationally important migratory bird species; and

- Narran Lake Nature Reserve regularly supports one percent of the individuals in a population of one species or subspecies of waterfowl. The large numbers of Black-winged Stilts (*Himantopus himantopus*), Red-necked Avocets (*Recurvirostra novaehollandiae*), Marsh Sandpiper (*Tringa staganatilis*), Straw-necked Ibis (*Threskiornis spinicollis*) and Red-kneed Dotterel (*Erythrogonys cinctus*) recorded in Narran Lake wetlands suggests that these wetlands may be of international importance for these species.

### **Impacts of Current Mining Activities**

Major impacts on vegetation that occur as a result of opal mining operations within the Narran-Warrambool Reserve include:

- clearing of mature vegetation;
- death of mature and regenerating trees in wet puddling dams;
- introduction of invasive exotic perennial species (for example, Buffel Grass), typically via truck movement, that may create a monoculture by competing with native ground cover species;
- removal of vegetation during construction of mining access tracks;
- poor rehabilitation of mining sites; and
- poor knowledge of species suitable for rehabilitation and adequate implementation.

Bimble Box/White Cypress Pine woodlands is the main vegetation type affected by mining within the Narran-Warrambool Reserve. Although opal mining does not usually result in the complete removal of tracts of vegetation within a mining area, removal of tree species is not governed by their age or habitat value.

Reserves exist in the western sector of the Walgett Regional Vegetation Management Plan boundaries Plan<sup>1</sup>. The Broad Vegetation Type that includes all Bimble Box communities has a ratio of clearing to reserved for conservation of 1:30. Consequently, only a further five percent (2041 hectares) of the original vegetation community should be developed in the future. This five percent threshold is one of the lowest of all the Broad Vegetation Types for the Walgett Regional Vegetation Management Plan and recognises that significant modification and/or clearing of this community has already occurred and further development within Bimble Box communities should be minimal. From a regional perspective the protection of this Broad Vegetation Type from excessive development and clearing is essential.

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<sup>1</sup> *The Draft Walgett Regional Vegetation Management Plan was prepared by the former Department of Land and Water Conservation and the Walgett Regional Vegetation Committee. Regional Vegetation Committees have now been disbanded and replaced by Catchment Management Authorities. This means that the Vegetation Management Plan will not be implemented in its current form. New vegetation mapping is now available from Department of Infrastructure, Planning and Natural Resources, but was not available at the time of writing.*

Disturbance of topsoil through mining activities, including site access tracks has resulted in the compaction of soil at most sites and consequently a reduction in native ground cover species. In some areas disturbance has also resulted in excessive regrowth of White Cypress Pine. The majority of mature White Cypress Pine at mining sites have been removed, died or are in poor health. Consequently, White Cypress Pine at mining sites are usually young and of low to moderate conservation value (*Photograph 6.3*).



Photograph Credit: Charles Sturt

### **Photograph 6.3: Regrowth of White Cypress Pine**

Impacts on fauna with the current mining areas of OPAs 1 to 3 include the removal of native vegetation, compaction and erosion of soils and removal of woody debris. The greatest possible impact upon fauna results in areas of Bimble Box and White Cypress Pine where opal mining is concentrated. The removal of hollow bearing trees, woody debris and ground cover species results in the loss of habitat for threatened and non-threatened fauna.

The retention of any mature hollow bearing trees in Bimble Box dominated ridges is of a high priority due to their current poor retention rates of this community within a regional context. Because of the extensive clearing of this community type in the east of Walgett Shire, the conservation and retention of similar communities in the west is necessary if species that survive on this community are to persist. Bimble Box/White Cypress Pine dominated ridges exist in a disturbed state within OPAs 1 to 3 and are less disturbed and therefore of high conservation value in OPA 4.

Woody debris is a vital habitat component for many ground-dwelling fauna particularly reptiles, ground dwelling mammals and the endangered Bush Stone-curlew. The removal of woody debris in opal mining areas has reduced the habitat available for fauna and so the conservation of the woody debris in other similar unmined habitats is

needed for the ongoing survival of these species in the region. New South Wales National Parks and Wildlife Service Scientific Committee has recently (12/12/03) listed the removal of dead wood and dead trees as a Key Threatening Process. Within this Key Threatening Process a number of threatened species have been specifically listed as depending on dead wood and dead trees, including species likely to occur in OPA 4 such as:

- Five-clawed Worm Skink (*Anomalopus mackayi*);
- Pink Cockatoo (*Cacatua leadbeateri*);
- Red-tailed Black-cockatoo (*Calyptorhynchus banksii*);
- Glossy Black-cockatoo (*Calyptorhynchus lathamii*);
- Barking Owl (*Ninox connivens*);
- Superb Parrot (*Polytelis swainsonii*); and
- Spotted-tailed Quoll (*Dasyurus maculatus*).

The nature of opal mining within the Narran-Warrambool Reserve is such that specific areas of mature Bimble Box will be affected by opal mining. The specific location of the next opal mining area is usually not known until mining has already begun. For this reason a cautious approach to the impacts of opal mining on flora and fauna is recommended.

Although tree removal, opal mining and limited rehabilitation within individual mineral claims has only localised impacts, the cumulative effect of many mineral claims under the same treatment is more significant. Currently, there are approximately six thousand mineral claims lodged with the Department of Mineral Resources with most lodged within a twenty square kilometre area. The cumulative affect of intensive mining in these areas is likely to have a significant impact upon both flora and fauna.

Eight part test were applied to the Five-clawed Worm-skink, Bush Stone-curlew, Pink Cockatoo, Red-tailed Black-cockatoo, Hooded Robin, Black-chinned Honeyeater Barking Owl, Koala, Superb Parrot, Grey-Crowned Babbler, Diamond Firetail and Painted Snipe. The tests were applied to these species in accordance with vegetation at and around the Opal Prospecting Areas where mining occurs or is likely to occur as well as known historical sightings for species in the region. Species chosen for the eight-part tests have known associations with the vegetation found in the region, including Bimble Box and White Cypress Pine Woodlands. Other threatened species have a range that extends over the study area but it is unlikely that these species will be affected by the impacts of opal mining. The assessment indicated that, on the knowledge gathered in this survey and previous surveys, continued opal mining in its current form is likely to result in a significant impact on the Five-clawed Worm-skink, Bush Thick-knee, Hooded Robin, Black-chinned Honeyeater, Barking Owl and Koala and therefore further investigation is recommended to the level of a Species Impact Statement to assist in developing a biodiversity plan for OPA 4.

The impact of the Proposal on Matters of National Environmental Significance identified in the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* was considered using the Administrative Guidelines for Significance. A number of

threatened species could potentially occur in the area and were considered in the application of the Guidelines. Similar to the state *Threatened Species Conservation Act 1995*, a blanket assessment method without more in depth survey has concluded a significant impact is likely and, therefore, further investigation is recommended to assist in developing a biodiversity plan for OPA 4 and avoiding significant impacts on threatened and migratory species.

### **Potential Impacts from Mining in OPA 4**

Similar impacts would be expected to occur within OPA 4 as the soils and vegetation are of the same type. Impacts to the sensitive Narran Lakes catchment should be avoided and a proposed three kilometre buffer around the lake is recommended to prevent sediment mobilised by mining activity from reaching the lake. Improved management of mining operations is recommended to avoid some of the impacts noted above and to reduce the intensity of other impacts. These measures are outlined below.

### **Recommended Mitigation Measures**

- Further investigations should be undertaken within OPA 4 to assist with biodiversity planning within the region. These investigations should be undertaken following consultation with the New South Wales Department of Environment and Conservation and the Commonwealth Department of Environment and Heritage and should aim develop a planned opening of OPA 4 such that there is no significant impact on threatened species. Areas of vegetation of high conservation value should be identified and set aside for conservation in a way that ensures each of the four main vegetation types listed in this report remain connected by one or more corridors of vegetation. This will ensure that at least some areas of each type of vegetation community are conserved in a high quality state.
- Production and implementation of an Erosion and Sedimentation Control Plan for all areas where opal mining occurs to reduce the likelihood of top soil loss and creek bed erosion as a result of small and large scale opal mining (refer *Section 6.2*).
- Removal of hollow bearing trees should be avoided wherever possible. If necessary removal should occur during the period January to May to avoid the breeding season of bats, birds or arboreal fauna and the cooler months when some species may be in torpor.
- Bonds for mineral claims should be increased to encourage claim holders to rehabilitate and revegetate mined areas.
- Revegetation via replanting with suitable indigenous species to be undertaken on mineral claims. This is already enforced for open cut mines.
- Claim holders bond should not be refunded until an inspection of rehabilitated and replanted mining site(s) is made and deemed adequate with at least a seventy-five percent plant survival rate within one year.
- A non-refundable environmental levy should be imposed on all opal mining claims regardless of their size to be used for environmental rehabilitation of current mining areas.

- A revegetation guide should be developed specific to opal mining in the Narran-Warrambool Reserve to ensure that appropriate local native species are being used for replanting.
- A list of local native seed suppliers should be developed to assist revegetation by claim holders.
- The extent of clearing and disturbance to the native vegetation should be kept to a minimum so that impact on flora and fauna is restricted.
- Where possible, puddling dams should not be located in areas that will cause the inundation and subsequent death of trees. They should be located in areas that are already disturbed and have been previously cleared away from drainage lines.
- Sizes of Mineral Claims should be reviewed (from 50 metres x 50 metres) if opal mining is to proceed in OPA 4, to determine if mining within larger areas (of less cumulative in number) results in a reduced impact compared to many small claims.
- An exclusion zone of a minimum of three kilometres should be established where no mining is to occur between OPA 4 and the boundary of Narran Lake.

## 6.4 Cultural Heritage

Heritage Concepts Pty Ltd was undertaken the Aboriginal and historic cultural heritage assessment. The assessment consisted of a desktop study of indigenous and non-indigenous heritage in the area and two site visits to the study area. The cultural heritage assessment report is presented in *Appendix E*. A summary of the assessment is given below.

### ***Existing Environment***

The study area is significant for its natural, palaeontological, Aboriginal, archaeological and historic values. It is a place that represents layers of meanings that make up the cultural landscape evident today. This landscape is dependant on the mythology of the Ularai and surrounding language clans, the fossil record, the natural vegetation and landscape. These are all interconnected with Aboriginal archaeological sites recorded, those yet to be recorded or discovered. The natural landscape is also connected to the early pastoral enterprises that created different boundaries across the land, that built homesteads and created stories related to early European settlers, and that also attracted the opal miners and their families.

The geology of the Lightning Ridge area, combined with erosion and depositional activity has resulted in three main soil types and topographies. The ridgeline, gravels and alluvial plains provide different ecological conditions favourable to complex vegetation and faunal communities. Although some species are common across all subdivisions, each zone also features unique plants and animals which are supported by the specific environment of that zone. Thus, within the immediate locale of Lightning Ridge there are several discrete environments with resources which were utilised by Aboriginal peoples. Some resource zones would have been accessed seasonally, i.e., ephemeral wetlands after prolonged rainfall, whilst others would have provided usable materials regardless of season, that is, quarries. The resources of the area were rich

enough to support several different clans, who moved through the landscapes, taking what was needed and keeping the land 'clean' with regular burning. Evidence of Aboriginal occupation is present in all these ecological zones, be it through either the physical evidence of relics or the spiritual evidence of remembrance of myth and dreaming stories.

There appears to have been very few archaeological investigations carried out in within the opal fields prior to the commissioning of this report, although the number of projects undertaken in the area is increasing.

The following is a summary of site types and concentrations within the Narran-Warrambool Reserve and are based on a Data License Agreement with the Department of Environment and Conservation (Including NSW National Parks and Wildlife Service), the Department of Mineral Resources and the Walgett and Lightning Ridge Local Aboriginal Land Councils.

The Aboriginal Heritage Information Management System (AHIMS) site search resulted in the identification of 490 registered sites within the Local Aboriginal Land Council boundaries of Walgett and Lightning Ridge. These sites are often a complex of different site types such as an open campsite, quarry and modified tree. These are often registered as one site complex and therefore, the number or total of site types is often under represented. For the purpose of this study, all site occurrences were recorded in order to gauge the diversity of site types. Therefore, the number of sites recorded will not reflect those that are registered with the Aboriginal Heritage Information Management System. Of the 490 sites registered on the AHIMS for the region, 184 sites are registered within the Narran-Warrambool Reserve. Of these, 5 are located within OPA 1; 65 in OPA 2; 48 in OPA 3 and 66 in OPA 4. The location and site type of the registered sites is shown in *Figure 6.2*.

The Narran-Warrambool Reserve presents a rich cultural landscape with a high potential for the presence of subsurface and surface Aboriginal cultural remains. Unfortunately, it is an area that has not been subject to systematic archaeological survey and study and therefore, the location of recorded sites in many instances is biased towards the survey methodology employed in the past. It can also be a reflection of chance finds as a result of prospecting and mining operations, and general development activities. Therefore, a statement of archaeological potential is constrained by past archaeological studies as well as past and current land use practices.

It is predicted that Aboriginal occupation and use of the Narran-Warrambool Reserve will have left several different types of evidence in the landscape. The environment of the region supported several different ecosystems, all of which provided resources for Aboriginal use.

Site characteristics will have the greatest effect on the differential preservation and visibility of sites in the area. Geomorphic processes are likely to have obscured sites on the alluvial floodplains, through the accumulation of silt after flood events. Floods serve to either cap (deposition of silt at regular intervals) or disturb (water flow velocity dislodging artefacts, potentially impacting on spatial distribution) sites in an area. Evidence from previous surveys in the area suggests that regional flooding has served to cap many of the sites on the floodplain. In addition to the natural processes at work,

post-contact land management practices are also likely to impact on site visibility and integrity. Broad acre tree clearance has removed scarred and carved trees, whilst large scale land shaping (ploughing, grading for roads etc) is also a major impact on artefact scatters and bora grounds etc. The introduction of grazing animals has also impacted the integrity of artefact scatters. Early river navigation has the potential to have disturbed relics such as stone and wooden fish traps. All these 'unintentional' impacts, are further compounded by the effects of historic artefact collecting. Many ornately carved trees have been felled and removed to private collections or museums, whilst 'mantelpiece' artefacts, such as stone axes and complete grindstones, have been collected by enthusiasts. The result is that the archaeological record as it remains today is a record not only of Indigenous people in the environment, but also of the last two centuries of impacts on that record.

It is predicted that all water sources (permanent and ephemeral) within the study area would have been used, although it is highly likely that evidence for such use may only be observable in slightly elevated areas that are not aggrading, or in lower lying aggrading areas where there is localised disturbance. Campsites would have been present within the black soil plains of the area, with previous reports suggesting that these are a little more likely to be located on the slight elevations present within this land class.

Lightning Ridge provides several sources of outcropping silcrete suitable for knapping. There is high likelihood for evidence of quarries within the Lightning Ridge land system. These may include area where stone was collected and also areas where initial working of the material was carried out. Present within these areas would be extensive scatters of debitage and potentially a higher percentage of cores. Mining in the area has the potential to have obscured or removed some quarry sites.

Scarred trees are a highly visible relic within the landscape, and appear to be present in all land class systems that supported mature tree growth. There seems to be a higher incidence of scarred trees in areas where two or more land class systems meet, however, this is not to suggest that scarred trees will not exist in areas of a single land class unit. It is predicted that there is a high likelihood for the presence of scarred trees in the study area in places where there are remnant stands of native trees.

There are no statutory heritage listings from within the Narran-Warrambool Reserve. However, the Australian Heritage Commission maintains a register of significant heritage items or places under the *Australian Heritage Commission Act 1975*, known as the Register of the National Estate. These listings are not legally binding but provide widely acknowledged recognition of the cultural value of the listed place or item. Listing of an item or place on the Register of the National Estate has certain implications for how Commonwealth agencies may deal with an item.

**Figure 6.2: Location of Aboriginal Sites as Recorded in the NSW Aboriginal Heritage Information Management System**



The National Trust maintains a register of heritage items and places. The National Trust Register has no legal foundation or statutory power, but is recognised as an authoritative statement on the significance to the community of particular items, and is held in high esteem by the public. The National Trust lists items or places which have heritage or cultural value to the community and as such the National Trust encourages and promotes the public appreciation, knowledge, and enjoyment of heritage items for future and present generations.

Nettleton's Shaft (the first shaft sunk at Lightning Ridge) is listed on the Register of the National Estate (Database Number 015854). Nettleton's Shaft is a registered item, and as such has been identified as a rare and historically important item. Within the wider area there are several sites listed on the Register of the National Estate, including Indigenous, historic and natural places such as the Lightning Ridge hot artesian bore baths and Walgett Shire Council Chambers. The Lightning Ridge General Cemetery is listed by the National Trust, however, this is also outside Reserve.

### ***Impacts of Current Mining Activities***

Opal mining has been an integral part in the establishment and development of Lightning Ridge. The activities associated with mining that today impact on the historic heritage landscape have also contributed to this landscape. The relationship between the historic and the contemporary values are intrinsically connected, yet tensions exist. These tensions are complex and dynamic. The existence of the cultural landscape of opal mining today is very much based on practices that have had a detrimental impact on Aboriginal cultural sites and places. Continuation of these activities also threatens the preservation of the historic mining landscape that defines Lightning Ridge from other opal mining towns in NSW.

Prior to the heritage preservation movement and the first legislation passed through parliament to protect Australia's cultural heritage, not a great deal of importance or relevance was attributed to the preservation of archaeological or cultural heritage, irrespective of whether they were Aboriginal or historical sites. The main issue with mining activities, in particular those that predate the introduction of Commonwealth and Federal legislation in the mid 1970s, is that they occurred prior to any regulation. This is particularly pertinent to the impact that these activities have had on Aboriginal archaeological and cultural sites.

Mining has been a constant part of the life and economy of Lightning Ridge and the opal fields' district and has shaped much of the existing heritage of the area. It is therefore important to provide safeguards to insure the protection and ongoing preservation of sites and places of Aboriginal and historic cultural importance.

### ***Issues associated with Aboriginal and Cultural Heritage***

There are four key issues associated with the impacts on Aboriginal and cultural heritage. Firstly, there is clear visibility and abundance of Aboriginal material culture, in particular lithic artefacts, and scarred or modified trees within the Narran-Warrambool Reserve. At present, there are no safeguards or protocols in place to address the potential impact of proposed or active mining claims on Aboriginal archaeological and material culture, regardless of whether sites are registered with National Parks and

Wildlife Service. The NSW *National Parks and Wildlife Act 1974* protects all Aboriginal relics in NSW, regardless of their status. It is illegal to destroy, deface, or damage any relics. This presents an area that needs to be addressed in the management of Aboriginal archaeological material cultural and heritage values in OPAs 1-3 and in particular, the proposed opening of OPA 4.

The second issue identified is the impact of mining activities with the preserved fields around Lightning Ridge. These areas are historic fields which are of great importance to the development of Lightning Ridge as a town, but also of the opal industry in New South Wales and Australia. It is important also to ensure that new claims and rehabilitation measures do not inadvertently destroy or remove material cultural relating to life and work on the fields.

The third issue that has bearing on the future management of the cultural heritage values of Lightning Ridge and the Narran-Warrambool Reserve is that there are no historic sites, places or cultural landscapes listed on the NSW State Heritage Register, although there are sites that have been listed with the National Trust of Australia (NSW). Unfortunately, the National Trust does not afford any legal protection to sites. Sites listed on the Register of the National Estate are only protected against Commonwealth actions or initiatives. Nettleton's Shaft and the surrounding fields should be listed on the NSW State Heritage Register and it is quite obvious that there are many places and sites of historic and cultural importance in and around Lightning Ridge that should be afforded protection. There are sites and places that are related to the early pastoral settlements and estates in the region that should also be recognised and protected. There is a lack of heritage studies and surveys for and around the opal fields which would assist in identifying and managing the historic heritage of these areas.

The fourth issue pertains to Aboriginal heritage values and archaeological sites. There are numerous sites registered on the NSW Department of Environment and Conservation Aboriginal Heritage Information Management System. However, the Reserve covers such a vast amounts of space that a basic site identification study, nor a comprehensive assessment of the distribution of sites, places and areas of archaeological importance has ever been undertaken. In short, it is an area that has been overlooked in previous academic research and cultural heritage studies. Those studies that do exist are in response to development or resource extraction pressures, and have never fully explored the extent and intensity of Aboriginal occupation and exploitation of the cultural landscape. Related to this last issue, is the fact that although there are many sites recorded on the National Parks and Wildlife Service Aboriginal Heritage Information Management System, there are potentially an equal if not greater number of sites and places, that have not been registered, recorded or relocated, but may be known to members of the local Aboriginal communities.

### ***Recommended Mitigation Measures***

- The release of OPA 4 should be staged. Each stage to be released should be subject to an Aboriginal and historic archaeological and cultural heritage assessment prior to the commencement of mining activities. This recommendation will ensure that unlike OPAs 1-3, management guidelines are in place for the protection of all cultural heritage items, places and values within OPA 4. At present, OPA 4 is the area with the most recorded sites within its boundary and this is prior to any systematic archaeological investigation taking place. It is

recommended that further sensitivity mapping be undertaken in conjunction with the biodiversity studies to ensure the best possible outcome for these two major issues.

- The Department of Mineral Resources should establish or identify an individual or position within their Lightning Ridge operations to take on the role of Aboriginal liaison officer for the processing of new and the management of existing claims. The objective of such a position would be the development of a close working relationship with all the relevant Aboriginal groups and stakeholders. At present, there is no consistency in the Aboriginal groups being consulted and thus, unintentional errors have been made with regards to the consultation and the seeking of approval for actions that have an impact on Aboriginal cultural values from inappropriate Aboriginal community members.
- The Department of Mineral Resources Aboriginal liaison officer should participate in discussions and workshops with all the Aboriginal Land Councils, Elders groups and stakeholders to determine the most appropriate method of communication regarding all Aboriginal cultural heritage matters in the study area. The objective is to establish a protocol or modus operandi for communications with the relevant Aboriginal elders or spokesperson. It is essential that all Department of Mineral Resources staff be made aware of these protocols. It is also essential that the Department of Environment and Conservation Regional Archaeologist is invited to participate in these workshops.
- All Department of Mineral Resources staff should follow the established Aboriginal communications protocol. This would ensure that if the individual (s) holding the position of Aboriginal Liaison Officer is replaced or absent, that the information is not lost and errors are avoided.
- For existing claims and prospecting licenses in OPAs 1-3, rehabilitation activities should be subject to an Aboriginal and historic archaeological assessment and impact statement. The objective of this recommendation is to ensure that if any Aboriginal or historic archaeological resources are uncovered or have been inadvertently destroyed as a result of the opal mining activity, that these cultural resources are recorded and assessed. Subsequently, an impact assessment will need to determine the most appropriate method of preserving or managing would cultural heritage resource during the environmental rehabilitation program. As a result of these assessments, the relevant Aboriginal elder or spokesperson should be consulted.

## **6.5 Climate and Air Quality**

### ***Existing Environment***

Meteorological information has been recorded by the Bureau of Meteorology at Lightning Ridge Bowling Club since 1997 (site number 048243).

The climate of the region is semi arid with hot summers and mild winters. Mean daily maximum temperatures vary between 36.2 degrees in January to 18.9 degrees in July. Average annual rainfall is 490 millimetres with the highest rainfall in October and

November. The predominant wind directions are northerly during October through to January, easterly from January through to May, westerly from May through to November, and southerly throughout the year. The mean number of days with strong wind is two per annum.

No air quality data are available for the region, however with the absence of significant urban or industrial development it is assumed that background air quality is good.

### ***Impacts of Current Mining Activities***

Air quality issues associated with the opal mining industry relate to emissions from petrol or diesel powered plant and equipment and dust generation. Dust may be generated from movement of vehicles along tracks or from machinery processing opal dirt such as blowers. Dust falling on vegetation is thought to cause productivity losses to farmers and potential sustainability issues in the general environment. Dust generation was raised as an issue through consultation with farmers, with specific reference to mullock dumps where finer grain material is found. Inspection of mining areas did not indicate any significant wind generated erosion of exposed surfaces. Dust is therefore likely to be an amenity issue during windy and dry periods.

### ***Potential Impacts within OPA 4***

Impacts within OPA 4 are likely to be similar to those experiences in the existing Opal Prospecting Areas.

### ***Recommended Mitigation Measures***

The following mitigation measures are recommended to manage dust generation:

- minimise exposed surfaces in mining areas;
- minimise removal of vegetation and ground cover;
- rationalise access roads and tracks to minimise exposed surfaces;
- site centralised mullock dumps a suitable distance from any residences or camps;
- fit effective dust filters to all machinery extracting or processing mining related material such as blowers; and
- where equipment is used in confined spaces, appropriate OH&S procedures should be followed. All plant and equipment should be regularly serviced and kept in good operating condition.

## **6.6 Land Use**

Land within the Narran-Warrambool Reserve is dominated by Crown Lands held under Western Lands Leases, administered by the Department of Infrastructure, Planning and Natural Resources. The ridge country, where opal mining generally occurs, has historically been used for grazing, with some cropping occurring on the dry lakebed. Within Walgett Shire it is estimated that 1.8 million hectares is used for extensive and low intensity land use (grazing) while a further 0.5 million hectares developed for moderate

to high intensity uses (such as cropping) (Department of Land and Water Conservation, 2002). Under the Rural Lands Capability System administered by the Department of Infrastructure, Planning and Natural Resources, pre-mined ridge country within the Narran-Warrambool Reserve is classified as Class VI lands, which are “not capable of being cultivated but suitable for grazing”. Under the Rural Land Suitability System administered by the New South Wales Department of Agriculture, pre-mining ridge country within the Narran-Warrambool Reserve is classified as Class 4 Lands that are suitable for grazing but not for cultivation. Under this classification agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be high seasonally but the overall level of production is low as a result of a number of major constraints, both environmental and edaphic (Cunningham *et al*, 1988).

The *Mining Act 1992* allows for an objection to be made to a mineral claim on the grounds that the land is “agricultural land). Schedule 2 of the *Mining Act 1992* defines agricultural land as:

- (a) *land that has been sown with not less than 2 crops of an annual species during the period of 10 years immediately preceding the relevant date, or*
- (b) *land that has been sown with 1 crop of an annual species during the period of 10 years immediately preceding the relevant date if the relevant authority is satisfied that:*
  - (i) *having regard to the date on which the land was brought under cultivation, it would not be reasonable to expect more than one such crop to have been sown, and*
  - (ii) *there was a sufficient reason for not having brought the land under cultivation at an earlier date, or*
- (c) *land on which:*
  - (i) *at the relevant date, shade, shelter or windbreak trees are growing, or*
  - (ii) *at any time during the period of 10 years immediately preceding the relevant date, edible fruit or nut bearing trees, vines or any other perennial crop approved by the relevant authority have or has been growing, or*
- (d) *pastures:*
  - (i) *that are sown with seed of a species and at a rate of application, or treated with fertiliser of a composition and at a rate of application, satisfactory to the relevant authority, and*
  - (ii) *that have, as a result of that sowing or treatment, maintained a level of pasture production that is substantially above that which might be expected of natural pastures, or*
- (e) *land that is used, to an extent acceptable to the relevant authority, for the production of grass seed, pasture legume seed, hay or silage, or*

- (f) *land that has a preponderance of improved species of pasture grasses.*

Under this definition most land within the 'ride country' of the Narran-Warrambool reserve is not defined as agricultural land within the meaning of the *Mining Act 1992*.

Opal mining within the Narran-Warrambool reserve is seen as temporary land use (Corkery, 2001) after which land may be returned to grazing purposes following rehabilitation.

### **Impacts of Current Mining Activities**

The major impact of mining activities is the clearing and modification of land making it unsuitable for grazing. The Lightning Ridge Land System is important to pastoral lease holders, as it provides better grass growth response to rain, provides refuge during times of floods and provides a source of timber. Opal mining operations tend to exclude grazing activities for safety reasons as well as loss of grasses in the vicinity of mines. Vegetation is cleared/lost as a result of construction activities, mullock dumps, puddling operations, vehicle movement, track building, mullock storage and the removal of trees for propping. While approval is required from farmers prior to the establishment of puddling operations and mullock dumps, these activities reduce the area of viable grazing land for a protracted period of time. Opal Field Management Plans are created in consultation with farmers and are designed to regulate opal mining activities to ensure that areas removed from landholders are managed and rehabilitated so that there is no long term loss of agricultural productivity.

Although there is a scheme in place providing land-holders with compensation for loss of land during mining activities (refer *Section 3.2.9*) many landholders argue that it undervalues the loss of amenity, disruption and environmental issues.

The potential impacts of mining operations in OPA 4 are likely to be similar to those that have occurred in OPAs 1-3.

### **Recommended Mitigation Measures**

The following mitigation measures are recommended to reduce the potential impacts on pastoral leaseholders and to appropriately compensate them:

- increase the security deposit paid for mineral claims to a level that will allow suitable rehabilitation and revegetation of the site following cancellation of the claim;
- monitor both rehabilitation and revegetation following cancellation of a claim;
- implement an environmental levy to be paid with each mineral claim to pay for rehabilitation of existing abandoned claims; and
- access tracks should be rationalised in consultation with Department of Infrastructure, Planning and Natural Resources, the Lightning Ridge Miners Board and landholders.

## 6.7 Noise and Vibration

A desktop assessment of potential noise impacts relevant to the subject site was undertaken. No targeted noise impact assessment of background noise readings were carried out as part of this investigation.

### **Existing Environment**

The local noise environment is expected to be consistent with a typical rural environment. Background noise levels within the Narran-Warrambool Reserve are likely to be low, but would differ depending on the land use area assessed. It is anticipated that background noise levels would be influenced by local fauna, general rural activities, movement of local traffic and possibly by current mining activities.

Within opal mining activities, noise may be generated from plant and equipment used during mining operations and vehicular movements. Typical plant includes:

- truck mounted drill rig or auger;
- diesel powered compressors;
- diesel power generators;
- spoil trucks;
- blowers;
- agitators (MPLs);
- augur drills;
- caldwell drills;
- short/long hoists;
- jackhammers;
- pumps;
- puddling operations; and
- hydraulic digging machines.

### **Impacts of Current Mining Activities**

Noise from mining operations is governed by the Department of Environment and Conservation (including the Environment Protection Authority) Industrial Noise Policy. The overall aim of this Policy is to allow the need for industrial activity to be balanced with the desire for quiet in the community and is specifically aimed at assessing noise from industrial noise sources scheduled under the *Protection of the Environment Operations Act 1997*.

The assessment criteria for industrial noise has two components:

- controlling intrusive noise impacts in the short term for residents; and

- maintaining noise level amenity for particular land uses for residents and other land uses.

In general, the intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous A weighted noise level from the source (known as LAeq) measured over a 15 minute period does not exceed the background noise level, measured in the absence of the noise source by five decibels (that is, LAeq (15 minutes)  $\leq$  rating background level + 5 dB(A)). Adjustments to the noise level may be required if the noise is subject to annoying characteristics such as prominent tonal components, intermittency, irregularity and dominant low frequency content. Meteorological impacts in the local area may also need to be taken into consideration when determining potential noise impacts.

However, to protect the noise amenity of the area and prevent background creep in noise levels, maximum ambient noise levels have been established in the Industrial Noise Policy. In the case of developing areas, such as the mining lease areas, the adopting of amenity criteria as a noise performance cap for cumulative noise from industrial development may be considered a reasonable and feasible approach.

The relevant amenity criteria for rural areas are given in *Table 6.3*.

**Table 6.3: Amenity Criteria for Rural Areas – EPA Industrial Noise Policy**

<b>Period</b>	<b>Acceptable Noise Level dB(A)</b>	<b>Recommended Maximum dB(A)</b>
Day	50	55
Evening	45	50
Night	40	45

Given that OPA 4 will be located away from the residential areas, the Industrial Noise Criteria would apply. While noise monitoring data are not available for mining operations areas, it is expected that the above amenity criteria would be exceeded for residences or camps within one kilometre of mining operations (under still isothermal conditions). It should be noted however that noise was not raised as an issue during stakeholder consultation. As these facilities are typically used by miners and families, the reduced amenity is likely to be tolerated as part of the lifestyle.

### ***Recommended Mitigation Measures***

In order to minimise the noise generated from current and futures site operations, general mitigation measures include:

- plant and equipment should be kept in good working order;
- use of properly fitted residential class mufflers;
- the hours of operation of any claim should be limited if close to residential areas;
- use of plant with lower noise levels where possible;
- site speed limits are to be imposed and followed on all vehicles;

- noise assessments should be conducted as part of the approval process for new mining operations close to residential areas; and
- Department of Mineral Resources should establish a noise complaints register to determine whether noise generation is an issue, and document action taken in response to complaints.

## **6.8 Hazard Assessment**

### ***Existing Environment***

The following hazards have been identified in relation to opal mining activities:

- potential risk of injury or death resulting from easy access to mining areas by the general public; and
- risk to the environment from spillage or improper disposal of fuel, oil and lubricants used for plant and equipment.

The opal fields are popular with tourists and there is little or no restriction of access. Hazards to the public in these areas include disused mine shafts, operating plant and equipment and derelict equipment and other waste materials. These hazards are well understood by the mining community through regular safety courses run by the Department of Mineral Resources, however the general public and specifically tourists visiting the opal fields may be unaware of the risks.

Noodling, where people pick over mullock dumps, is an illegal activity that creates safety and liability issues. Noodlers often expose themselves to serious accidents and injuries by moving about amongst trucks as they tip mullock onto dumps and as the title holder is responsible for ensuring public safety on the claim area liability issues can result.

In recent years there has been a strong focus by the Department of Mineral Resources on improving safety in the opal fields and a significant reduction in the numbers or accidents, injuries and fatalities has resulted.

The Department of Mineral Resources Safety Operations Program requires a continuing process of assessing; investigating and verifying appropriate safety systems, processes and standards. Some of these reviews are undertaken unannounced.

There is currently a requirement for all new claim holders in the region to undertake the Lightning Ridge Miners' Safety Course before having their claims registered by the Department of Mineral Resources (Annual Report 2002). A third edition of the Lightning Ridge Opal Mining Safety Guidelines has also recently been published. This document aims to improve safety standards on the opal fields.

The Technical Services Program administered by the Department of Mineral Resources provides specialist safety technical advice to industry and also coordinates the development of safety guidelines and assessment documents. The program is also used to test materials, chemicals, diesel exhaust emissions, escape breathing apparatus and gas monitoring systems uses in NSW mines.

Due to the isolation of the mining areas, refuelling and servicing of plant and equipment is generally carried out in the field. Inspection of mining areas indicated oil staining in some areas, which suggests that oil leaks or improper disposal of waste oils is taking place. Fuels, oils and lubricants are stored in drums without secondary containment.

### ***Recommended Mitigation Measures***

The following measures are recommended with regard to safety:

- installation of signage along access roads to mining areas and within these areas warning of potential hazards trespassing;
- encouraging tourists to take a guided or escorted tour of the opal fields; and
- preparation of an information sheet for distribution through the tourist centre warning of hazards and advising appropriate precautions to take when visiting mining areas.

Fencing or restricting access to the opal fields is not practical due to the large area involved and the high cost of erecting and maintaining fences. This would also detract from the tourist potential of these areas. However, given that OPA 4 is located approximately 40 kilometres away from the main township of Lightning Ridge, the number of tourists may be lower than in OPA 1.

The following measures are recommended with regard to refuelling:

- encourage miners to service and refuel equipment in town wherever possible;
- provide facilities for collection of waste oils and lubricants at centralised locations and advertising the location of these facilities; and
- encourage the use of secondary containment measures such as bunding or spill pallets to contain leakage from drums.

## **6.9 Visual Assessment**

The landscape of the Narran-Warrambool Reserve comprises largely of floodplains and some ridge environments. The floodplains are generally well cleared and are periodically inundated during high rainfall events. They consist of red gravels, limited black soils, and sand ridges. The ridges are generally well vegetated with red soils. The visual quality of the region is impacted by a variety of land uses that include farming, mining and urban development.

### ***Impacts of Current Mining Activities***

Opal mining has a relatively high visual impact. Almost all activities associated with mining have a visual impact, for example the construction of mining infrastructure, clearing of vegetation and stockpiling of mullock. Excavated subsurface materials from mines are predominately white and contrast strongly with generally red topsoils. Subsurface materials create an impact as mullock heaps, dumps, puddling sediment ponds and are sometimes used for track building. The creation of centralised mullock dumps was partly implemented to reduce the visual impacts of individual dumps.

Mining sites are often characterised by ad hoc development and can be littered with discarded machinery and other waste including old car bodies and mining equipment. Generally, this kind of debris is confined to the preserved fields where residential camps are permitted. As there will be no residential camps in OPA, this kind of litter is not expected. While disturbed mining areas represent a stark contrast to the surrounding landscape they are a tourist attraction for the region. Tourists come to Lightning Ridge to view the altered landscapes created by mining activities.

### ***Recommended Mitigation Measures***

While it is recognised that some aspects of mining operations that alter the visual landscape draw tourists to the area, others do not. The following recommendations relate to decreasing the potential visual impacts on the development of new mining areas:

- prevent the use of subsurface materials for road building;
- ensure that all rubbish and derelict equipment is removed from mining areas both during mining and following its cessation; and
- ensure that sites are rehabilitated and revegetated after mining has ceased.

## **6.10 Access**

Under the *Mining Act 1992* the title holder of a mineral claim is entitled to a right of way between the claim and the nearest practicable point of a public road. The creation of tracks has generally been uncontrolled and multiple tracks may exist as a result of vehicles detouring around rough or boggy ground. Many of the tracks have been created in an unsuitable manner, resulting in erosion problems and bogging of vehicles during wet periods.

The Western Lands Amendment Act aims to rationalise tracks and access within the western division.

### ***Recommended Mitigation Measures***

Many issues that relate to access tracks and erosion have been covered in Geology and Soils (*Section 6.2*). Specific measures include:

- site access and the management of roads and tracks should usually be in accordance with the landholder's wishes, and tracks should be kept to a minimum, to prevent the creation of soil erosion and destruction of vegetation. A wet weather route may need to be established should the main route become inaccessible;
- track maintenance responsibilities should be clearly defined in the property management plan; and
- information on how to construct and maintain tracks in a sustainable manner should be provided by Department of Mineral Resources.

## 6.11 Social and Economic Aspects

### ***Existing Environment***

Social and economic aspects have been discussed in *Section 4.2*. The social and economic centre of the opal fields is the township of Lightning Ridge, which was established in the early 1900s for the purpose of servicing the mining community. While Lightning Ridge has an official population of approximately 1,700, it is estimated that this figure is probably significantly underestimated with the inclusion of opal miners and their families who are temporary residents or not recorded by the census. The LRMA has reported that approximately 8,200 people collect mail from Lightning Ridge post office (Maxine O'Brien, pers comm). An earlier estimate based on a count of dwellings in 1994 by the Department of Mineral Resources provided a total of approximately 6,500 people living in Lightning Ridge, camps on Claims and Gramin/Glengary/Sheepyards. The low number of residents counted in the census means that the region is likely to receive less government funding for infrastructure and services than the true population warrants.

The nature of opal mining and the lifestyle that it engenders has attracted a wide range of people to Lightning Ridge and has resulted in a highly multicultural community. This is reflected in the range of services and attractions in the region. It has also engaged a strong community spirit with many of the facilities in town funded by private rather than public sources.

Opal mining provides a substantial contribution to the local community of Lightning Ridge, in terms of creating a demand for goods and services and the injection of capital into the local and regional economy. The Lightning Ridge area is the world's number one source for black opals in both quantity and quality (Department of Mineral Resources, 2002). Production was valued at \$39 million in 1999-2000, \$58 million in 2000-01 and \$48 million in 2001-02. It is estimated that there is more than \$70 million of capital equipment invested in the Lightning Ridge Opal mining industry used by independent miners who have annual expenses estimated at \$4.5 million.

The Lightning Ridge area receives a significant number of tourists that also contribute to the local community. In 2003, between April and August, the Lightning Ridge Visitor Information Centre recorded 7,060 visitors, with 80 percent staying more than one night. Approximately one out of three visitors are aged over 55, with probably 60 percent towing caravans. A large proportion of visitors are from Sydney, Brisbane, Central Coast and Victoria travelling through to Queensland (Rebsolutions, 2003).

Tourists are attracted in a large part because the opal mining, as practiced, represents living history reminiscent of the pioneer days in the outback. The money generated by the opal industry and tourism has been reinvested in many of the town facilities such as the swimming centre and increasingly the town of Lightning Ridge is displacing Walgett as the major regional centre in terms of the range of services it provides to the local area. In recent years the town has become part of the 'fossil trail' through New South Wales being presented by the Australian Museum with the discovery of 'opalised' fossils. An opal and fossil centre is being planned as a future tourist attraction (Barbara Moritz, pers comm).

### ***Impacts of Current and Mining Activities***

The Lightning Ridge community relies on a healthy opal mining industry to help sustain the region. The nature of opal mining means that miners are typically self-employed individuals, small partnerships or families. There is very little corporate activity in the industry reflecting the nature of opal deposits, which are small and widely dispersed, current legislation. The flow on effect of miners in the community and the tourists that come to see the mining is large. Employment outside the mining industry is limited. Women often work in industries such as hospitality and tourism and can be the main wage earner in the family. Agriculture also plays an important role in supporting the local community.

In recent years, the price of black opal has declined. It is believed that this is a direct result in the decline in tourism to the region from Asia, in particular Japan, which has traditionally been the strongest market for black opal. International issues such as the economic downturn in the Japanese economy, SARS and continuing concerns regarding international security continue to keep overseas tourist levels below those experienced in the late 1990s. Given the significant capital investment required for individual mining operations, the decline in opal prices has had a major impact on the Lightning Ridge community. For example, it is currently estimated that 70 percent of the population is receiving some kind of government support (Barbara Moritz, pers comm).

### ***Potential Impacts within OPA 4***

The Opal Mining Association estimate that opal production has decreased by 70 percent over the last 10 years, primarily due to the lack of ability to obtain new fields caused by regulations, native title restrictions, environmental requirements and cost increases (Opal Mining Association, 2001). While new fields are still available within OPAs 1-3, OPA 4 is seen as providing increased availability of sites.

The development of OPA 4 is seen by the mining community as providing a potential new source of high quality gemstones that has the potential to reinvigorate the industry in much the same way as the boom in the Coocoron Fields in the 1980s and early 1990s occurred. This speculation is based on the assumption that the similar geology of the 'ridge country' in the south should lead to opals being present. As there is currently no way to assay for opals, the only way to test this proposition is for mining to commence in OPA 4.

Given that OPA 4 is located approximately equidistant from Lightning Ridge and Walgett, it is possible that significant new fields within OPA 4 could see a shift in focus of mining activity and associated services from Lightning Ridge to Walgett.

### ***Recommended Mitigation Measures***

It should be recognised that the needs of the mining, agricultural and tourism industries need to be considered in the development of OPA 4.

Consideration needs to be given by Walgett Council in relation to infrastructure and servicing necessary to support mining activities in this area. The release of Opal Prospecting Blocks by the Department of Mineral Resources should be controlled and conducted in liaison with Council and mining representatives to ensure that mining of

the area is conducted in a planned way and to allow for the provision of appropriate services. All permanent residents should be encouraged to register on the electoral roll and fill out Census forms for the 2006 Census so that an accurate representation of population can be obtained. This would assist in Lightning Ridge in demanding increased funding for services and infrastructure from both local and state governments.

## **6.12 Waste and Resources**

### ***Existing Environment***

Wastes generated by opal mining include mullock, fines from puddling, oils, lubricants, sewage and discarded machinery. Old mining areas can contain a significant amount of rubbish and discarded machinery and car bodies. The long term effects of mining waste, particularly mullock, are largely unknown.

While sewage associated with mining camps is generally not considered a problem, because of the arid environment, potential exists for the development of unsanitary conditions where there camps are concentrated and remain for a long period of time.

A philosophy of reuse of materials and equipment exists on the opal fields, where old machinery is repaired, rather than replaced, which reduces demand for new resources. This sees machinery that would often be discarded adapted to an alternative function. When machinery eventually breaks beyond repair, or a claim is completely worked, this machinery may not be disposed of properly due to a lack of money.

Under Item 9 of the conditions to hold a mineral claim, miners are required to maintain the site in reasonable order and that those found to be breaching the legislative requirements could be liable to fines up to \$1,100.

Efforts have been made to rid the fields of waste, including a project co-ordinated by the Lightning Ridge Miners Association which saw the removal of many tonnes of abandoned car bodies.

Opal mining relies heavily upon machinery to move large quantities of soil and electricity for camps and mines is generally obtained from diesel generators. This results in the consumption of non-renewable fuels. Some use of solar power occurs for domestic purposes.

### ***Recommend Mitigation Measures***

The following measures regarding waste and resources are recommended:

- mullock dumps should only be created subject to specific guidelines/requirements;
- annual clean up campaigns should be jointly organised and funded by the Lightning Ridge Miners Association and Department of Mineral Resources to remove derelict machinery. Miners should be encouraged to participate in this activity;

- waste dumps and rubbish dumps should be of such design and construction that they can be easily rehabilitated and restored in such a manner that they will not be easily distinguishable from the surrounding landscape after restoration;
- mullock dumps should be fully rehabilitated within the same time frame as assigned to registered claims;
- wastewater disposal within the peroc should be investigated to determine whether the current practices are satisfactory from a public health viewpoint; and
- the use of renewable forms of energy should be encouraged where possible to reduce the quantity of non-renewable resources consumed.

### **6.13 Cumulative Effects**

Cumulative effects refer to the combined impacts of the proposed release of OPA 4 with other existing or potential development in the area. In terms of opal mining, the proposed development of OPA 4 must be viewed in the context of past and current mining activities in OPAs 1-3. Mineral claims within OPAs 1-3 cover an area of approximately twenty square kilometres that is already likely to be having an impact on the environment. Additionally there will be further impacts from associated access tracks and infrastructure such as mullock dumps. The current mining activities are likely to be having impacts on flora and fauna, cultural heritage, visual amenity and land use. The opening of OPA 4, even with appropriate mitigation measures in place, is likely to add to the cumulative impacts of opal mining in the Narran-Warrambool reserve.

The main cumulative impact within the Narran-Warrambool reserve will result from vegetation clearing associated with mining combined with vegetation clearing for agriculture. While there is no discrete vegetation clearing data for the Narran-Warrambool Reserve or even for Walgett Shire, it is estimated that in the northern wheat belt of New South Wales the annual clearing rate was 6,724 hectares between 1985 and 1994, 10,694 hectares between 1994 and 1998 and 7,034 hectares between 1998 and 2000 (Department of Land and Water Conservation, 2002). It is estimated that permission will be given to clear 40,000 hectares of existing grazing land over the next ten years within Walgett Shire, 34,000 hectares in the west of the shire (Department of Land and Water Conservation, 2002). The majority of this clearing is likely to occur in the non ridge country where cropping is a viable alternative. Mining activities will contribute to the clearing and modification of vegetation within the Narran-Warrambool reserve, but will focus mainly on the ridge country. Without appropriate conservation planning within OPA 4, the combined effect of vegetation clearing from mining and agriculture may have a significant impact on biological resources of the area.

### **6.14 ESD Considerations**

Ecologically Sustainable Development refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs using, conserving and enhancing the community's resources so that ecological

processes are maintained, and the total quality of life, now and in the future, can be increased. Four principles of sustainable development are;

1. intergenerational equity (ensuring the health of the environment is maintained for the benefit of future generations);
2. the precautionary principle (avoiding serious or irreversible damage to the environment in the absence of scientific knowledge);
3. environmental economic valuation (the true cost of environmental impacts should be factored into the valuation of assets and services); and
4. biodiversity conservation (conservation of biological diversity and ecological integrity).

The cumulative aim of these approaches is to prevent and reverse adverse impacts of economic and social activities on the environment, while continuing to allow the sustainable, equitable development of societies.

### ***Intergenerational Equity***

The ESD principle of intergenerational equity includes social equity that involves the concepts of justice and fairness so that the basic needs of all sectors of society are met and there is fair distribution of costs and benefits to improve the welfare of the community. OPA 4 would provide ongoing benefits for local communities by providing both direct and indirect economic benefits.

The proposed program of conservation planning within OPA 4 would promote the future conservation of biological resources.

A philosophy of reuse of materials and equipment exists on the opal fields, where old machinery is repaired, rather than replaced. The negative effect of this is that when machinery becomes irreparable, it is often not disposed of properly.

### ***Precautionary Principle***

In application of the precautionary principle care should be taken to avoid serious or irreversible environmental damage and an assessment of consequences should be undertaken in formulating a project. The precautionary principle means that if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In this situation there is a high degree of scientific certainty regarding impacts of opal mining, although there is less certainty about the best methods of site rehabilitation after mining.

Lack of knowledge of the regional impacts of opal mining and the current environmental condition within OPA 4 has led to a recommendation of a stages opening of the opal prospecting area and further investigations into the sensitivity of the area.

### ***Valuation and Pricing of Environmental Resources***

This principle establishes the need to determine economic values for services provided by the natural environment, including cultural values and visual amenity. The environment has historically been considered a free resource. One method for

determining the real cost of an activity is to recognise the costs of mitigating the effects of the activity on the environment. The costs involved in the implementation of mitigation and rehabilitation actions have been widely investigated.

The current system of bonds has limited rehabilitation potential, as it is retained as a penalty for miners not rehabilitating their claim and covers only the mining site and not the impacts on surrounding areas. In many instances the bond is of such a low value that it is easier for the miner to forfeit the bond rather than rehabilitate the claim. The proposal of imposing an annual environmental levy on mining leases would provide for environmental works undertaken in the wider area – for example removal of rubbish (including broken and discarded machinery), rehabilitation, revegetation and erosion control measures.

### ***Biodiversity Conservation***

Maintaining biological diversity safeguards life support functions of the environment that are considered a minimal requirement for intergenerational equity. The major impact from mining activities on biodiversity comes from clearing of native vegetation. Past vegetation clearing for agricultural purposes has increased the conservation value of vegetation on the ridge country where opal mining occurs. Clearing of vegetation in this area is likely to have a significant impact on threatened species that occur in the region. A program of further investigation has been proposed that includes biodiversity planning at the scale of the opal prospecting Area such that areas of high conservation value are protected from mining activities while mining can proceed in areas of lesser value.



# 7. Environmental Management

## 7.1 Summary of Mitigation Measures

The mitigation measures recommended in *Section 6* of this report have been summarised in *Table 7.1*. Mitigation measures have been grouped according to:

- further investigation;
- licensing;
- policy;
- location;
- rehabilitation and revegetation; and
- specific environmental issues.

These mitigation measures are then formed into management action in *Section 7.2*.

**Table 7.1: Summary of Recommended Mitigation Measures**

<b>Environmental Aspect</b>	<b>Mitigation Measure</b>
Further Investigation	<ul style="list-style-type: none"> <li>▪ Further investigations should be undertaken within OPA 4 to assist with biodiversity and conservation planning within the region. These investigations should be undertaken following consultation with the New South Wales Department of Environment and Conservation and the Commonwealth Department of Environment and Heritage and should aim develop a planned opening of OPA 4 such that there is no significant impact on threatened species or items of cultural significance.</li> <li>▪ Investigate wastewater disposal within the peroc to determine whether the current practices are satisfactory from a public health viewpoint.</li> </ul>
Licensing	<ul style="list-style-type: none"> <li>▪ Bonds paid for mineral claims should be increased to encourage claim holders to rehabilitate and revegetate mined areas.</li> <li>▪ Sizes of Mineral Claims should be reviewed to determine if mining within larger areas is more feasible than many small claims.</li> <li>▪ Construction of roads or access tracks should require the approval of the Department of Mineral Resources as part of the granting of a mineral claim.</li> <li>▪ Claim holders bond should not be refunded until an inspection of rehabilitated and replanted mining site(s) is made and deemed adequate with at least a seventy-five percent plant survival rate within one year.</li> <li>▪ A non-refundable environmental levy should be imposed on all opal mining claims regardless of their size to be used for environmental rehabilitation of current mining areas.</li> </ul>

<b>Environmental Aspect</b>	<b>Mitigation Measure</b>
Policy	<ul style="list-style-type: none"> <li>▪ Department of Mineral Resources should establish a noise complaints register to determine whether noise generation is an issue, and document action taken in response to complaints.</li> <li>▪ Site specific erosion and sedimentation control plans should be developed for intensive areas of activity including wet puddling areas, mullock dumps and open cut mines.</li> </ul>
Location of claims and fields	<ul style="list-style-type: none"> <li>▪ An exclusion zone of a minimum of three kilometres should be established where no mining is to occur between OPA 4 and the boundary of the Narran Lake.</li> <li>▪ Guidelines should be developed for on-site wastewater disposal within mining camp areas. Consideration could be given to the establishment of communal facilities in long term camp areas.</li> </ul>
Rehabilitation and revegetation	<ul style="list-style-type: none"> <li>▪ Existing areas where compaction has occurred and mining has ceased should be suitably rehabilitated.</li> <li>▪ Rehabilitation via replanting to be made compulsory on mineral claims in addition to that already enforced for open cut mines.</li> <li>▪ A revegetation guide should be developed specific to opal mining in the Narran-Warrambool Reserve to ensure that appropriate local native species are being used for replanting.</li> <li>▪ A list of local native seed suppliers should be developed to assist revegetation by claim holders.</li> </ul>
Climate and Air Quality	<ul style="list-style-type: none"> <li>▪ Minimise exposed surfaces in mining areas.</li> <li>▪ Site centralised mullock dumps a suitable distance from any residences or camps.</li> <li>▪ Fit effective dust filters to all machinery extracting or processing mining related material such as blowers.</li> </ul>
Flora and Fauna	<ul style="list-style-type: none"> <li>▪ Removal of hollow bearing trees should be avoided wherever possible. If necessary removal should occur during the period January to May to avoid the breeding season of bats, birds or arboreal fauna and the cooler months when some species may be in torpor.</li> </ul>
Cultural Heritage	<ul style="list-style-type: none"> <li>▪ Department of Mineral Resources should establish or identify an individual or position within their Lightning Ridge operations to take on the role of Aboriginal liaison officer for the processing of new and the management of existing claims.</li> <li>▪ The Department of Mineral Resources Aboriginal liaison person should participate in discussions and workshops with all the Aboriginal Land Councils, Elders groups and stakeholders to determine the most appropriate method of communication regarding all Aboriginal cultural heritage matters in the study area.</li> <li>▪ All Department of Mineral Resources staff should follow the established Aboriginal communications protocol.</li> </ul>
Geology and Soils	<ul style="list-style-type: none"> <li>▪ For existing mining areas, review the existing network of roads and tracks and close unnecessary roads. This should be done in consultation with the Lightning Ridge Miners Association, miners and grazing leaseholders.</li> </ul>

<b>Environmental Aspect</b>	<b>Mitigation Measure</b>
	<ul style="list-style-type: none"> <li>▪ Carefully plan access roads and tracks to new mining areas and provide formalised drainage to minimise erosion risk and control sedimentation.</li> <li>▪ The open cutting of subsided areas should be encouraged where environmentally appropriate as a means of encouraging ongoing mining activity ultimately rehabilitating the mined landscape.</li> <li>▪ Areas of subsidence that are not suitable for open cutting should be stabilised and rehabilitated. Areas where subsidence is active should be monitored on an ongoing basis.</li> </ul>
Hazard Assessment	<ul style="list-style-type: none"> <li>▪ Install signage along access roads to mining areas and within these areas warning of potential hazards.</li> <li>▪ Encourage tourists to take a guided or escorted tour of the opal fields.</li> <li>▪ Prepare an information sheet for distribution through the tourist centre warning of hazards and advising appropriate precautions to take when visiting mining areas.</li> <li>▪ Encourage miners to service and refuel equipment in town wherever possible.</li> <li>▪ Provide facilities for collection of waste oils and lubricants at centralised locations and advertising the location of these facilities.</li> <li>▪ Encourage the use of secondary containment measures such as bunding or spill pallets to contain leakage from drums.</li> <li>▪ Noisy plant should be fitted with silencers when operated close to residential or camp areas.</li> <li>▪ Hours of operation of any claim should be limited if close to residential areas.</li> <li>▪ Appropriate Occupational Health and Safety procedures should be followed for equipment operators and personal protective equipment used.</li> <li>▪ Waste oil from oil changes to equipment in the field should be collected in a sealed container and transported to the nearest collection point.</li> </ul>
Visual Assessment	<ul style="list-style-type: none"> <li>▪ Prevent the use of subsurface materials for road building.</li> <li>▪ Ensure that all rubbish and abandoned plant is removed from mining areas.</li> </ul>
Waste and Resources	<ul style="list-style-type: none"> <li>▪ Annual clean up campaigns should be jointly organised and funded by the Lightning Ridge Miners Association and Department of Mineral Resources to remove derelict machinery. Miners should be encouraged to participate in this activity.</li> <li>▪ Waste dumps and rubbish dumps should be of such design and construction that they can be easily rehabilitated and restored in such a manner that they will not be easily distinguishable from the surrounding landscape after restoration.</li> <li>▪ Mullock dumps should be fully rehabilitated within the same time frame as assigned to registered claims.</li> </ul>

Environmental Aspect	Mitigation Measure
Water Management	<ul style="list-style-type: none"> <li data-bbox="699 286 1394 376">▪ The use of renewable forms of energy should be encouraged where possible to reduce the quantity of non-renewable resources consumed.</li> <li data-bbox="699 387 1394 477">▪ New wet puddling sites should provide for return of water from settlement dams to the water supply dams to minimise losses within the operation.</li> <li data-bbox="699 499 1394 611">▪ The establishment of new wet puddling operations should be preceded by consultation with the grazing lease holder to establish cooperative arrangements for the potential shared usage of the water resource.</li> <li data-bbox="699 633 1394 689">▪ No extraction of surface water should occur from the Narran River and associated wetland system within OPA 4.</li> </ul>

## 7.2 Environmental Management Process

### 7.2.1 Existing Process

The Department of Mineral Resources works under an environmental management policy that states:

*The Department is committed to meeting the community's expectations on environmental care. Out of this commitment it has developed a policy which will form the basis for a series of guidelines for the exploration and mining industries. This policy sets out the obligations for industry and the Department.*

*The policy recognises that:*

- *Environmental management and rehabilitation are integral parts of all exploration and mining processes.*
- *The concerns and interests of the community and occupiers or owners of land potentially affected by exploration or mining should be recognised in the planning, operational and rehabilitation phases of these processes.*

*To meet the policy the Department has committed to:*

- *Setting appropriate conditions on titles granted.*
- *Advocating and supporting best practice in environmental management through policy documents and supporting guidance notes.*
- *Inspecting, monitoring, auditing and enforcing environmental performance required by conditions; maintaining a high level of technical expertise in environmental matters.*
- *Effectively communicating with the mining industry, other government agencies and the public.*

- *Leading by example through a commitment to excellence in its own operations.*

With regard to opal mining within the Narran-Warrambool reserve, environmental issues are usually treated through a compliance approach. Impacts associated with opal mining are regulated by regional staff from the Department of Mineral Resources. The *Mining Act 1992* provides in part for the control of activities within mineral claims. However, this control becomes less effective as the number of registered claims within a localised areas increase significantly. In such cases a management plan is prepared for the field in order to ensure the responsible management of mineral claims.

Associated with the management process is a series of bonds (*Section 3.2.9*) aimed at ensuring that processes such as the rehabilitation of finished mine sites is undertaken.

Most of the management process is however concerned with safety issues such as the closing of mine shafts, rather than true environmental issues.

## **7.2.2 Proposed Management Changes**

The proposed management changes are based on consolidation of the mitigation measures outlined in *Section 6* and summarised in *Table 7.1* and can be divided into seven sections that are discussed below.

### ***Additional Investigations***

The current large-scale assessment of environmental impacts has suggested that there may be significant impacts associated with opal mining in OPA 4 on flora and fauna and cultural heritage. It is therefore recommended that further investigations be undertaken in order to plan for the opening of OPA 4 such that significant impacts are avoided as is the need for an Environment Protection and Biodiversity Conservation Act referral or a Species Impact Statement at the level of a mineral claim.

Because of the vast size of Opal Prospecting Area 4, it is proposed that a three stage approach is taken to the assessment of impacts.

Stage 1: This would include a biodiversity and conservation planning study undertaken in consultation with the Commonwealth Department of Environment and Heritage and the NSW Department of Environment and Conservation such that there is no significant impact on threatened species or cultural heritage. It is envisaged that these studies would identify areas of sensitivity within OPA 4 in which opal mining should not be allowed, areas in which mining could potentially proceed with further investigation and areas of low sensitivity in which mining could proceed. Areas of vegetation of high conservation value should be identified and set aside for conservation in a way that ensures each of the four main vegetation types listed in this report remain connected by one or more corridors of vegetation. This will ensure that at least some areas of each type of vegetation community are conserved in a high quality state.

Stage 2: More detailed studies in smaller portions of Opal Prospecting Area 4 prior to these areas being opened to better identify areas of sensitivity.

Stage 3: A checklist environmental assessment carried out by the miners at the time of lodging a mineral claim and reviewed by staff of the Department of Mineral Resources. The checklist should include:

- the location of the claim, to be checked against the environmental assessment of the Opal Prospecting Block;
- the number of trees above a set diameter (as an indication of vegetation health);
- an indication of vegetation to be cleared;
- a mud map of the site including drainage lines and access tracks; and
- an assessment of clearly identifiable cultural heritage artefacts.

While it will be the responsibility of the miner to complete the checklist, it should be assessed by the Department of Mineral Resources environmental officer based on information contained in the environmental assessment of the Opal Prospecting Block. Random checks of information provided should be made in the field. If necessary, further information should be requested prior to granting of a mineral claim. An example of the checklist assessment is provided in *Appendix F*.

### **Staffing Issues**

In order for environmental management to be fully implemented within the Narran-Warrambool Reserve it is recommended that the Department of Mineral Resources employ a permanent environmental officer to ensure environmental management is considered in the new and existing pal mining areas. This position will serve to assess environmental impacts of existing and new mineral claims and the effectiveness of environmental rehabilitation programs. This officer could serve the dual role of providing environmental and cultural heritage advice. This role should be an opportunity for Department of Mineral Resources to train a local resident.

### **Size of Mineral Claims**

The current size of mineral claims (0.25 hectares) is not of sufficient size to allow appropriate rehabilitation of the site and cumulatively they are hard to manage. The Department of Mineral Resources are proposing that in OPA 4 that the size of mineral claims should be increased to one hectare. Careful consideration should be given to the economic viability of such a sized site to ensure that mineral claims are still a viable option for lone operators.

### **Rehabilitation and Revegetation of Mineral Claims**

Rehabilitation of opal mine sites has consisted primarily of securing the safety of the site and has largely ignored the rehabilitation of environmental characteristics, including revegetation. Limited revegetation trials have taken place at a number of sites within the Narran-Warrambool reserve including at Les's 8 Mile Opal Field (Howell, 2000). In these ongoing trials at Les's 8 Mile Bore, 36 fenced and 36 secured shaft sites have been seeded with a combination of introduced and native seed and fertiliser. However, the majority of revegetation trails have suffered from a lack of consistency in the application of treatments, the use of non-native species and lack of post-treatment management such as fencing to exclude predators. There have also been trials of the rehabilitation of

waste dumps (Rhodes, unknown date). The three main problems associated with revegetation of opal mining waste dumps appear to be high salinity of the soils, excessive slope and lack of topsoil. The use of fresh topsoil was found to greatly increase vegetation establishment, but in many areas topsoil is not available. Deep contour ripping and the provision of protective ponding banks have to a certain degree been shown to also be effective in allowing vegetation establishment (Rhodes, unknown date).

Revegetation should be undertaken at any site where opal mining alters vegetation from its initial structure before opal mining occurs. The revegetation program should plant native and indigenous local species that occurred within the mined area prior to mining.

Rehabilitation by replanting local native species will attempt to improve connectivity and increase the area of suitable habitat for flora and fauna within and around opal mining areas.

It is recommended that the guidelines for rehabilitation for open cut rehabilitation be extended to rehabilitation of all mineral claims. With appropriate planning and management of mineral claims, the area needing rehabilitation may be kept to a minimum. The factors that should be considered include:

- appropriate erosion and sedimentation controls;
- do not make the area flat and smooth as this will prevent water and wind blown seed from being retained on site. Generally the site should be deep ripped;
- only local native trees and shrubs are to be planted;
- larger plants can be easier to establish than tube stock;
- trees should to be planted in depressions, provided with small earth banks to assist them in catching rain water runoff;
- tree guard, or fencing of the site may be required to stop animals from eating plants. This is a particular problem in relation to hares;
- place mulch at the base of trees to minimise water loss through evaporation;
- in dry conditions, watering of trees may be necessary (no more than once per week);
- avoid planting from September to March, when warmer weather will mean that the plants may die;
- tree and shrub planting at a ratio of ten trees/shrubs to every one removed should be undertaken to compensate for the loss of canopy cover and understorey species;
- if possible and after negotiation with Department of Mineral Resources and the Western Lands Lease holder the revegetated area should be excluded from grazing until the trees and shrubs are well established; and
- the site should be inspected by the Opal Field Environment Officer prior to any bond being returned to ensure that revegetation has been successful.

It is recommended that more detailed consideration of revegetation be undertaken as part of the Species Impact Statement.

### ***Changes to Security Bonds***

The security bond associated with mineral claims should be increased to better reflect the true costs of rehabilitating claims. Current estimates of costs to adequately rehabilitate abandoned claims are between \$450 and \$550 (Corkery, 2001). This rehabilitation does not include revegetation and is based on a mineral claim of 0.25 hectares. It is likely that the costs of rehabilitating and revegetating mineral claims of one hectare in size would be close to \$2,000. Although this may be viewed as a significant increase, it should be considered in relation to the capital value of equipment used by miners at Lightning Ridge which in many instances would exceed \$100,000 per operation.

### ***Environmental Levy***

It is recommended that annual non-refundable environmental levy be charged for each mineral claim. The levy could be used to pay for rehabilitation/revegetation works on existing abandoned sites. The monies could be administered jointly by the Lightning Ridge Miners Association and the Department of Mineral Resources through a trust fund.

### ***Rationalisation of Tracks***

As part of the opening of OPA 4 there should be planning and rationalisation of access tracks. Within the existing Opal Prospecting Areas there should be again be rationalisation and rehabilitation of closed tracks. Currently as part of the compensation scheme, ten dollars per claim is set aside for the Road Fund, which is used to repair degraded roads. Some of these funds should be diverted to rehabilitation of disused tracks.

## 8. Conclusion

The Department of Mineral Resources is proposing to open up OPA 4 to opal mining activities. OPA 4 is located within the Narran-Warrambool Reserve and covers an area of 1600 square kilometres. This REF assessed the environmental impacts from existing and future opal mining and prospecting operations within the Narran-Warrambool reserve. The approach taken in preparing this REF was to examine the impact of the existing mining operations and the effectiveness of mitigation/rehabilitation measures in order to assess the sustainability of ongoing operations within OPAs 1, 2 and 3 and the measures needed to allow mining/prospecting to commence in OPA 4.

This review assessed the potential impacts of opal mining on a range of environmental aspects that are summarised in *Table 8.1*.

**Table 8.1: Summary of Expected Environmental Impacts**

	<b>Anticipated Environmental Impact</b>
Water Management	Opal mining activities have minor impacts on both surface and ground water resources.
Geology and Soils	The principal impacts on soils associated with opal mining operations are related to erosion, compaction and subsidence.
Flora and Fauna	The major impact associated with flora and fauna is the clearing of native vegetation. Vegetation within the ridge country when most opal mining occurs has been heavily cleared in the past and therefore has a high conservation value. Adopting a broad-scale, precautionary approach to impact assessment there is likely to be a significant impact on threatened species listed under both the <i>Threatened Species Conservation Act 1995</i> and the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Cultural Heritage	Opal mining has been an integral part in the establishment and development of Lightning Ridge and surrounding area. The activities associated with mining that today impact on the historic heritage landscape have also contributed to this landscape. The existence of the cultural landscape of opal mining today is very much based on practices that have had a detrimental impact on Aboriginal cultural sites and places. Continuation of these activities also threatens the preservation of the historic mining landscape that defines Lightning Ridge from other opal mining towns in New South Wales.
Climate and Air Quality	Air quality issues associated with the opal mining industry relate to emissions from petrol or diesel powered plant and equipment and dust generation.
Land Use	The major impact of mining activities is the clearing and modification of land making it unsuitable for grazing. Opal mining operations tend to exclude grazing activities for safety reasons as well as loss of grasses in the vicinity of mines.
Noise and Vibration	Impacts associated with noise and vibration are likely to be minimal.
Hazard Assessment	Impacts from opal mining include the potential risk of injury or death resulting from easy access to mining areas by the general public and risk to the environment from spillage or improper disposal of fuel, oil and lubricants used for plant and equipment.

<b>Anticipated Environmental Impact</b>	
Visual Assessment	Almost all activities associated with mining have a visual impact, for example the construction of mining infrastructure, clearing of vegetation and stockpiling of mullock. Excavated subsurface materials from mines are predominately white and contrast strongly with generally red topsoils.
Access	Impacts related to access include the proliferation of tracks within the Western Land Leases and a lack of rehabilitation of this infrastructure.
Social and Economic Aspects	The main impacts of mining on social and economic aspects have been positive. The township of Lightning Ridge was founded to service the mining community. The nature of this community has been shaped by the people attracted to the opal mining industry. Opal mining has a flow on effect in creating jobs in retail, tourism and hospitality industries.
Waste and Resources	Wastes generated by opal mining include mullock, fines from puddling, oils, lubricants, sewage and discarded machinery. Old mining areas can contain a significant amount of rubbish and discarded machinery and car bodies.
Cumulative Impacts	The main cumulative impact will result from vegetation clearing associated with mining combined with vegetation clearing for agriculture.
Ecologically Sustainable Development	Opal mining and the proposed mitigation measures would be generally in accordance with the principles of ecologically sustainable development.

The major impacts from opal mining within the Narran-Warrambool reserve are related to flora and fauna and cultural heritage. This conclusion is due in part to the precautionary approach adopted in the report because of the vast size of the reserve and the lack of data from the region. As a result the primary recommendation of the review is carrying out additional investigations in order to plan for the opening of OPA 4 such that significant impacts are avoided as are the need for an Environment Protection and Biodiversity Conservation Act referral or a Species Impact Statement at the level of a mineral claim.

With the opening of OPA 4, the Department of Mineral Resources has the opportunity to implement a program to ensure that opal mining can occur in the region while at the same time promoting conservation and biodiversity needs. This will mean that opal mining within OPA 4 can proceed in an environmentally sound and sustainable manner.

## 9. References

Cooperative Research Centre for Freshwater Ecology. 2002. *Scoping Study for the Narran Lakes and Lower Balone Floodplain Management Study*.

Corkery, R W and Co. Pty. Ltd. 2001. *Discussion Paper: A Review of the rehabilitation Objectives for New Opal Fields of the Narran-Warrambool Reserve, Lightning Ridge*. Department of Mineral Resources.

Corkery, R. W. and Co. Pty. Ltd. 2002. *Recommendations Arising from Stakeholder Meetings and Site Inspections to Discuss the Review of Rehabilitation Objectives for New Opal Fields of the Narran-Warrambool Reserve, Lightning Ridge (Second Draft)*. Department of Mineral Resources.

CRC for Freshwater Ecology. 2002. *Scoping Study for the Narran Lakes and Lower Balone Floodplain Management Study*.

Cunningham, G. M., Higginson, F. R., Riddler, A.M.H. and Emery K.A. 1988. *Systems used to classify rural lands in New South Wales*. NSW Department of Land and Water Conservation.

Department of Conservation and Land Management. 1993. *Carrying Capacities Map*.

Department of Mineral Resources. 1996. *Minfact No. 15, March 1996*.

Department of Mineral Resources. 1997. *A Management Plan for New Opal Fields – Opal Mining in the Narran-Warrambool Reserve Lightning Ridge*. Lightning Ridge Mining Board.

Department of Mineral Resources. 1999a. *'Mineral Claims for Mullock Dumps – A Draft Policy*.

Department of Mineral Resources. 1999b. *'Guidelines for applicants for mining leases for puddling within the Narran-Warrambool Reserve'*. Mines Inspection Branch NSW Department of Mineral Resources.

Department of Mineral Resources. 2002. *Lightning Ridge Opal Mining Safety Guidelines*. Department of Mineral Resources, Sydney.

Department of Mineral Resources. 2003a. *'Notes on proposed amendments to the Mining Act 1992 for Stakeholders Consultation'*. Department of Mineral Resources, 21 October 2003.

Department of Mineral Resources. 2003b. *Request for Quotation – Lightning Ridge Opal Fields Environmental Assessment and Review of Environmental Factors*.

Department of Land and Water Conservation, 2002. *Draft Walgett Regional Vegetation Management Plan*. Department of Land and Water Conservation, Walgett.

Goodwin, M. P. 2002. *Introduced Flora and Weeds on the Lightning Ridge Opal Fields*.

Howell, D. 2000. Les's 8 Mile Opal Field. *Mininfo* 67: 60-61.

Interim Lightning Ridge Mining Board (1995) '*Rehabilitation Policy, The Opal Fields of the Narran-Warrambool Reserve*' – A policy developed in conjunction with the NSW Farmers' Association, The Landholders' Protection Association, The Lightning Ridge Miners' Association and the Grawin, Glengarry Sheeppark Miners' Association.

Johansson, W. 2003. The Lightning Ridge Information website: <http://www.wj.com.au/index.html>.

Leechman, F. 1982. *The Opal Book*. Lansdowne Press, Sydney.

Lightning Ridge Miners' Association. 2004. 'Opal Mining within the Narran-Warrambool Reserve, Lightning Ridge. Review of Environmental Factors, LRMA Response'. Report written for the LRMA by Mr Alan Condon. Submitted to Dept of Mineral Resources (22 September 2004).

NSW Farmers and Landholders Representatives on the Lightning Ridge Mining Board (2003) '*Draft – Narran/Warrambool Mining Reserve Standard Property Management Plan*'.

Opal Mining Association. 2001. Submission to the Fuel Taxation Inquiry, Commonwealth Treasury Department ([http://fueltaxinquiry.treasury.gov.au/content/Submissions/Industry/AOI\\_286.asp](http://fueltaxinquiry.treasury.gov.au/content/Submissions/Industry/AOI_286.asp))

Rebolutions. 2003. Weekly visitors tally for Lightning Ridge. Email provided by Maxine O'Brien.

Rhodes, D.W. (Unknown date). Rehabilitation of opal mining areas, Lightning Ridge, New South Wales. Soil Conservation Service of New South Wales.

Walgett Shire Council. 1997. *Camps in the Opal Fields of Lightning Ridge ("Camps Guidelines")*.

Watkins J.J. 1984. *Future Prospects for Opal Mining in the Lightning Ridge Region*. Department of Mineral Resources, Sydney.

## **Appendix A**

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Clause 228 Checklist



The *Environmental Planning and Assessment Regulation 2000* requires that all matters identified in Clause 228 are addressed in accordance with a determining authority's responsibility for the proposal. *Table A.1* indicates where each of the matters listed in Clause 228 is addressed and the likely impacts.

**Table A.1: Clause 228 Checklist**

<b>Factor</b>	<b>Reference in REF</b>	<b>Likely Significant Impact?</b>
(a) Any environmental impact on a community	<i>Section 6.5</i>	No
(b) Any transformation of a locality	<i>Section 6</i>	No
(c) Any environmental impact on the ecosystems of the locality	<i>Section 6.4</i>	No
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	<i>Sections 6</i>	No
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	<i>Sections 6</i>	Yes
(f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i> )	<i>Section 6.4</i>	Yes
(g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	<i>Section 6.4</i>	Yes
(h) Any long-term effects on the environment	<i>Section 6</i>	Yes
(i) Any degradation of the quality of the environment	<i>Section 6</i>	No
(j) Any risk to the safety of the environment	<i>Section 6</i>	No
(k) Any reduction in the range of beneficial uses of the environment	<i>Section 6</i>	No
(l) Any pollution of the environment	<i>Section 6</i>	No
(m) Any environmental problems associated with the disposal of waste	<i>Section 6.7</i>	No
(n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	<i>Section 6</i>	Yes
(o) Any cumulative environmental effect with other existing or likely future activities	<i>Section 6.11</i>	No



## **Appendix B**

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Department of Mineral Resources  
Rehabilitation Standards for  
Cancelled Claims and the Safety-  
minimum Standards Required for  
Securing Shafts and Auger Holes  
on Registered Claims

## **Appendix C**

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Minutes of Stakeholder's Meetings

# Review of Environmental Factors - Opal Mining Activities at Lightning Ridge Minutes of Meeting

## Stakeholder Workshop

**Date:** Thursday 14 August 2003

**Location:** Lightning Ridge Bowling Club

**Attendees:** Kylie Kent (Charles Sturt University), Leigh Thompson (Charles Sturt University), Lori Sciusco (Heritage Concepts), Maxine O'Brien (Lightning Ridge Miners Association), Ross Slack Smith (Grazier), Bob Barrett (LRMA), Hugh Swinbourne (Parsons Brinckerhoff), Lisa France (Parsons Brinckerhoff), Ormie Molyneux (LRMA), Matthew Goodwin (Walgett Shire Council), Rebel Black (Lightning Ridge Visitor Information Centre), Warwick Schofield (Department of Mineral Resources), Drago Panich (LRMA), David Howell (DMR), Peter Bell (GGsMA), Richard Lake (Walgett Local Aboriginal Land Council – Dharriwaa Elders Group), Lewis Beale (Walgett Local Aboriginal Land Council – Dharriwaa Elders Group), Mary Morgan Creighton (Walgett Local Aboriginal Land Council – Dharriwaa Elders Group), George Fernando (Chairperson North West Region Land Council), George Rose (Dharriwaa Representative – Senior Yuwaalaraay Chair WLALC), Wendy Spencer (Dharriwaa Elders Group WAMS)

**Attachments:** PB Presentation

Issue	Minutes:	Actions
<b>1</b>	<b>Project Overview</b>	Note
	Lisa France and the PB study team provided an overview of the scope and process for the Review of Environmental Factors.	
<b>2</b>	<b>Stakeholder Comments and Issues</b>	
2.1	Tourism	
	<ul style="list-style-type: none"> <li>• Lightning Ridge is perceived to be an interesting place to visit. Aside from mining, key attractions are the lifestyle and people.</li> <li>• The uniqueness of the town is related to opal mining.</li> <li>• Tourism supports most businesses in town.</li> <li>• There is the potential for ecotourism related to aboriginal culture.</li> <li>• A tour of a working mine is needed to enhance tourist potential. This is difficult to set up due to liability insurance issues. There have been deaths from working mine tour operations in the South Australian opal fields.</li> <li>• Flora and fauna provide attractions within the Permissive Occupancy zone surrounding the town (Per Oc). The animals are attracted by watering points in the Per Oc.</li> <li>• Visitor data has been collected since April 2003. During the four months</li> </ul>	

Issue	Minutes:	Actions
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to end of July, approximately 7,000 people visited the tourist centre. Based on NSW Tourism figures only 1 in 3 tourists typically attend visitor centres and therefore the estimated overall tourism from April to July 2003 is 21,000 people.

- A lot of people are also attracted by town facilities such as the swimming centre.
- There are no data available on the economic value of tourism. It is suggested that PB contact Natalie Dunstan at Walgett Council to obtain shire information. PB to contact Natalie Dunstan
- The Lightning Ridge website gets approximately 40,000 hits per month.

2.2 Aboriginal Heritage

- The aboriginal community is concerned over the potential for mining near Narran Lake as this is considered a significant area.
- Ted Fields snr has been consulted on a regular basis regarding aboriginal cultural issues in relation to mining areas. LRMA is aware of the dreaming trail along the ridge line and other sensitive cultural sites in the region.
- It was commented that George Rose is the senior elder in relation to this region and is the appropriate person to consult.
- It was suggested that money collected from miners for the Native Title trust be used to mark out the dreaming trail and to protect significant sites rather than being allowed to go back into consolidated revenue.
- The aboriginal community is concerned on the effect on local fauna from clearing mining access roads. Protection for native birds was mentioned as a particular concern.
- Miners believe that mining activities have less effect on cultural heritage than grazing activities.
- The elders group is training aboriginal site officers.
- Identification of sites is considered important to keep aboriginal culture alive in the region.
- The aboriginal population of Walgett is approximately 1,200.
- A heritage study was conducted by John Watkins through DMR in 1983.
- A heritage study has been commissioned through Murdi Pakki – Bourke office of ATSI. Michael Stewart is conducting this study.
- Request for additional consultation and field assessment by Lori Sciusco with aboriginal groups. PB to discuss with DMR.

<b>Issue</b>	<b>Minutes:</b>	<b>Actions</b>
2.3	Koalas	
	<ul style="list-style-type: none"> <li>• SEPP 44 is the appropriate environmental planning instrument in relation to Koala habitat.</li> <li>• Bimblebox is noted as a key habitat tree under SEPP 44. It was noted that Koalas also utilise Coolabahs in the black soil country.</li> </ul>	
2.4	Agricultural Issues	
	<ul style="list-style-type: none"> <li>• Farmers are not generally anti-mining.</li> <li>• Loss of access for farmers in the vicinity of mining areas is an issue.</li> <li>• There are problems with miner's dogs attacking farmer's working dogs.</li> <li>• Problems exist with loss of fences and gates on properties.</li> <li>• There is an overall loss of control for the farmer with mining activity.</li> <li>• Property impacts can be mitigated by a good property management plan with effective monitoring of compliance.</li> <li>• Centralised dams/puddling sites are seen to be a good thing. They enhance fauna, reduce dust generation and provide overall efficiency for the industry. They also restrict overall traffic generation.</li> <li>• Concern over impacts of mining on black soil areas.</li> </ul>	
2.5	Land Use and Planning Issues	
	<ul style="list-style-type: none"> <li>• Matthew Goodwin has been tasked with preparing a new LEP covering the Lightning Ridge area. The current LEP dates back to 1968. A draft was prepared in 1990 but never gazetted.</li> <li>• In terms of land use, Council want to see a balance between mining, tourism and farming.</li> <li>• There is a possibility of Walgett Shire merging with Brewarrina. Brewarrina has an LEP that was prepared by a consultant about 5 years ago.</li> </ul>	
2.6	Water	
	<ul style="list-style-type: none"> <li>• The best combination of water for mining purposes is a mix of surface water and artesian water.</li> <li>• There is no water in Narran Lake at present.</li> </ul>	
2.6	General Comments	
	<ul style="list-style-type: none"> <li>• Weeds are an issue for the preserved fields surrounding the town. John Hosking from NSW Agriculture in Tamworth was noted as a contact in relation to weeds.</li> <li>• Socio economic and heritage values are seen to be important considerations for the REF.</li> <li>• Environmental and property compliance is an issue for farmers. Maxine O'Brien indicated LRMA support for improved compliance noting that</li> </ul>	PB to contact John Hosking.

<b>Issue</b>	<b>Minutes:</b>	<b>Actions</b>
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previous environmental sweeps conducted by DMR had been successful.

- It was noted that the majority of past compliance problems in the Coocoran field were from South Australian miners who were not familiar with local conditions and standards.

Circulation: Attendees, Ken Hollands (DMR)

**Meeting:** Consultation with Farmers regarding the Lightning Ridge REF

**Date:** 28 October 2003

**Location:** Leon Cravino's property

**Attendees:** Lisa France (PB), Warrick Schofield (DMR), Leon Cravino, Terry Willis, Ross Baxter and Louise Crites-Foster

- The slopes on the mullock heaps are too steep for cattle to graze on
- An EIS is needed not a REF
- The term 'rehabilitation' is used loosely and means different things to different people. (The implication is that something that has been rehabilitated is revegetated however this is not the intended meaning of the word when used by DMR. DMR use the word rehabilitated to mean that the site is secured for safety purposes).
- The farmers do not oppose the mining of OPA 4 provided it is controlled.
- The farmers do not believe that the mineral claims conditions are met before the land is handed back to the property owner.
- Ross believes that the potential of OPAs 1-3 should be fully exhausted and then rehabilitated before miners are allowed access to OPA 4.
- The farmers don't believe that the property agreements are enforced and don't think that they will control activities on farming properties
- Why cant the miners buy the properties they want to mine (eg the purchase of a property by the GGGsMA). Bigger mining companies such as Western mining have to either purchase properties or put options on them (that is, pay compensation) to gain access to the mineral reserve – why cant opal mining operate the same way?
- The miners should not be able to live on the claims as the conditions are poor (no sanitation facilities, inadequate services etc). If the miners where to live in town then the town would do better and the amenity and health issues could be addressed.
- Farmers don't believe they have any rights as the legislation supporting mining over rides farmers.
- Farmers believe that the location of mullock dumps is at the total discretion of miners and DMR and that the farmers have no say in it. (Warrick explained the consultation process between the DMR and land holder (AKA farmer) that takes place to determine the location. LF asked for a name for a farmer who has had a mullock heap forcefully put on their property in order to further discuss this matter. Gordon Kelly is the landholder who's name was given but according to the farmers he is happy with the arrangement due to the compensation paid.)
- The problem with mullock heaps is the reduction in grazing area, the aesthetics of white on red, the fine particulate matter coating the trees and running off across the land surface, concern regarding toxicity and the ultimate impact on property value when it comes to resale.
- (the issue of toxicity was discussed and results were tabled but LF explained that this material couldn't be used in the REF due to uncertainty about source, analysis, chain of custody, triplicates etc and asked if an analysis was to be done as part of the REF and it came back and

said the material was inert would they then be satisfied? The answer was no as it is an aesthetic and health issue too.)

- farmers are not happy about white material being used on the roads due to the aesthetics, runoff and the coating of the vegetation.
- Claim that there is a lot of people in the area with respiratory problems due to the fines in the white material. LF explained how air quality monitoring is undertaken and what the term PM10 means and discussed the dust settlement guideline of 2gm/m<sup>2</sup>/month.
- Farmers do not believe that the compensation paid is enough. Compensation rates were a while ago and need to be revisited. Compensation is paid in order to accommodate for the miners being on the property but not for the location of mullock heaps.
- Farmers not happy with the rebadging of WASTE DUMPS to MULLOCK HEAPS (think that it is dumbing down the issue).
- Instead of creating mullock heaps, Leon believes the material should be placed into old gravel pits and other such depressions.
- The farmers consulted are unhappy about the potential for mullock heaps to be placed on their properties.
- There is a belief that mullock heaps are kept at 2 ha because if they were any larger they would trigger an EIS which would say that they were not permitted (general consensus that one consolidated mullock heap is more environmentally detrimental than a heap of individual smaller heaps. LF explained that if the consolidated dump is managed correctly then the impacts would be less than scattered individual dumps with their own run off, access tracks, clearance footprints etc).
- Condition No.7 from the Conditions of a Mineral Claim is being ignored (the replacement of disturbed material prior to moving on).
- OPA 4 is red soil as opposed to black and red soils as is the case in OPAs 1-3. OPAs 1-3 can be cropped when the miners move into the grazing land but in the case of OPA 4, when the miners move into the grazing land the farmers have no alternate source of income. The miners come onto the properties and will disturb the paddock rotation system the farmers have in place (where they rest one area while farming others and then rotate these areas).
- Farmers would like to see sunset clauses on areas to allow rehabilitation to take place and the handing back of the land to occur.
- Rehabilitation and control of miners (through the processes in place) needs to have teeth. Farmers don't believe that the current practices are threatening enough.
- Farmers questioned DMRs priorities and the fact that they are responsible for enforcing the rules but of course are going to encourage mining. Farmers believe that DMR need to be doing more enforcing.
- Farmers questioned the cost of the bond and rehabilitation and suggested that if the real cost was factored in then mining wouldn't be as feasible. Farmers believe that if the miner can't afford to rehab to the applicable standard then they shouldn't be allowed to mine.
- Western Lands Act: says you can't move material from one property to another but the miners are allowed to do this and this activity has the potential to spread weeds, ticks, anthrax, contamination etc.

- There is a problem with the miners putting some of the mullock back in the hole and then the remainder (that cant fit) is moved to an adjacent property in order for them to get their bond back (but the adjacent property doesn't get checked and the mullock remains).
- Issue with dogs on site.
- Concerned about not preserving top soil
- Not happy with the mining that has gone on over the past few years which is supposed to be to a better environ standard. (Gordon Kelly's property was shown as an example where there are access tracks everywhere, veg clearing, mullock on roads, very high waste dumps etc.

Aboriginal consultation 15/12/03 as well as details from Heritage report.

## **Appendix D**

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Flora and Fauna Assessment  
Report

## **Appendix E**

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Aboriginal and European Heritage  
Report

## **Appendix F**

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Checklist REF Proforma