Red Lake gypsum mining, MLA77/528 and L77/172, 2km east of Chandler, Shire of Nungarin

---

Aurex Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 929
March 1999

ISBN. 0 7309 8133 9
ISSN. 1030 - 0120
Assessment No.1155

Summary and recommendations

Aurex Pty Ltd, in joint venture with Mr K J Fitzgerald, proposes to mine gypsum at Red Lake, 46 km north-east of Merredin within Mining Lease Application M77/528 which is a vacant Crown land "window" within the Lake Campion "C" Class Nature Reserve 24789. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

Although a number of environmental factors were considered by the EPA in the assessment, it is the EPA's opinion that the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) Vegetation - loss of significant vegetation

(b) Terrestrial fauna - cumulative impacts of loss of habitat

(c) Landscape - effect on landscape values

Conclusion

The EPA has considered the proposal by Aurex Pty Ltd to strip-mine gypsum at Red Lake on vacant Crown land enclosed by the Lake Campion C-Class Nature Reserve.

It is the EPA's opinion that the proposal is unlikely to be successful in restoring the existing vegetation within the proposed project area due to the unique local soil conditions to which the vegetation community is adapted. Replacement of unique vegetation associated with the dune system with more common salt-tolerant vegetation on dune remnants would result in a reduction in biodiversity of the region.

Although rare or declared flora were not found to be present within the project area, the EPA considers that, given the unique nature of gypsophilic and gypsum-tolerant plant communities which differ according to individual dunal substrates, considerable caution should be exercised in considering an application to clear such vegetation, especially in regard to the probability that some species may yet be undetected.

The EPA notes that extensive clearing of native vegetation has already occurred in the greater region of the project area. In the Avon Wheatbelt region less than 1% of the native vegetation has been set aside for conservation (Thackway and Cresswell, 1995). In the Shire of Nungarin where the project is located, only 9.7% of uncleared or unmodified vegetation is protected on publicly owned land (Beeston *et al* 1995).

Accordingly, the EPA has concluded that proposal cannot be managed to meet the EPA's environmental objective for vegetation.

Although rare fauna are not likely to be found within the project area, the EPA considers that the project is likely to contribute to cumulative impacts on fauna biodiversity within the reserve and also the greater region in which the reserve is located.

It is the EPA's opinion that the proposal has the potential to adversely impact on the natural features of the Red Lake and its surrounds, particularly the surrounding nature reserve which has high landscape and heritage values. Consequently the EPA has concluded that the proposal cannot meet the EPA's objective for maintaining landscapes which are compatible with their surrounds, especially in a region which has been severely depleted of natural values through clearing of native vegetation.

The need for access to gypsum for soil remediation purposes in some areas of agricultural land has been considered by the EPA. There have been discussions within government agencies

about the need for a strategic examination of the resource, its availability and constraints, and what additional measures are required to ensure that the use of gypsum is supported by the best agricultural practice. The EPA supports the preparation of a State Gypsum Supply Strategy.

Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors of vegetation, terrestrial fauna and landscape values as set out in Section 3.
2. That the Minister notes that the EPA has concluded that the proposal cannot meet the EPA's environmental objectives and cannot be managed in an environmentally acceptable manner, such that the biodiversity of the Lake Campion Nature Reserve and its surrounds is not further reduced.
3. That the Minister notes that the EPA has not provided conditions and procedures to which the proposal should be subject because the EPA has concluded that the proposal cannot be managed in an environmentally acceptable manner.
4. That the Minister notes that the EPA is preparing a position statement in relation to mining of gypsiferous dunes which support remnant vegetation communities of high biodiversity value.
5. That the Minister supports the development of a State Gypsum Supply Strategy, similar in scope to the State Gravel Supply Strategy (Main Roads of WA, 1996), such that remnant vegetation communities on gypsum dunes on public land are adequately protected when the requirements for gypsum are considered.

Contents

Tables

Figures

Appendices

1. Introduction

Aurex Pty Ltd (the proponent), in joint venture with Mr K J Fitzgerald, propose to mine gypsum at Red Lake located some 46 km north-east of Merredin (Figure 1). The proposed Red Lake mining area is indicated in Figure 2. The Mining Lease Application is located on vacant Crown land in a window in the Lake Campion "C" Class Nature Reserve 24789, 300 km east of Perth in the South West Mineral Field within the Shire of Nungarin. The total lease area is 15.8 ha of which 10 ha consists of gypsum dunes; the remainder of the lease being either samphire on the edge of Red Lake or swale on the landward side of the dune. The proposal also includes Miscellaneous Licence application L77/172 of 0.12 ha, which provides access to the mining lease through the nature reserve from adjacent farm land.

The mining lease has been pegged over some 660 m of gypsum dunes which have formed along the south-east margins of Red Lake. The formation of the dunes is a consequence of the gathering of wind-blown particles removed from the lake by prevailing winds during hot dry weather.

Lake Campion Nature Reserve was gazetted in 1957 with an area of 688 ha and has been progressively expanded up until 1979 to give a total area of about 10,752 ha. Of this total area approximately 80 to 90% consist of salt lakes (Beard, 1980). The Reserve is vested in the National Parks and Nature Conservation Agency (NP&NCA). The Mining Lease Application was applied for before the nature reserve, hence the Mining Lease is described as a "*window in the nature reserve being located on vacant Crown land*". The reserve consists largely of salt lakes, principally Lakes Campion and Brown, with gypsum dunes on the south and easterly margins of the lakes.

The proponent has applied for a Mining Lease over the gypsum dunes, submitting a Notice of Intent (NOI) to the Department of Minerals and Energy (DME) on 25 April 1997. The NOI was referred to the EPA on 29 May 1997 by the proponent's consultant because of the location of the Mining Lease totally surrounded by a "C" Class Nature Reserve. The level of assessment of the project was initially set at "Informal Review with Public Advice". However, following an appeal, the level of assessment was subsequently set at Consultative Environmental Review (CER).

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposal. Section 4 presents the EPA's conclusion and Section 5 the EPA's recommendations.

A list of organisations that made submissions is included in Appendix 1. References are listed in Appendix 2.

The DEP's summary of submissions and the proponent's response to those submissions have been published separately and are available in conjunction with this report.

2. The proposal

The proposal is to divide the gypsum dunes within the tenement, consisting of about 10 ha, into 11 areas, or panels, of approximately equal volume. Mining would consist of sequentially removing the gypsum dunes on a panel by panel basis. Vegetation and the top 10 cm of gypsum, containing organic material and seeds, would be removed prior to mining for later respreading over the mined area. Each panel would be mined and rehabilitated in sequence with no more than one panel being exposed for mining at a time.

The mined gypsum is intended to be sold for use on agricultural land for soil conditioning purposes.

It is planned for the main gypsum stockpiles to be held on the cleared farm land immediately outside of the Mining Lease and nature reserve (Figure 2). A truck would be loaded on site and would transfer gypsum to the stock-piling area. Access between the Mining Lease and the farmland stock-pile area would be via a corridor 89 m long and 16 m wide, located on Miscellaneous Licence application L77/172 (0.12 ha), which crosses the Nature reserve at its north eastern boundary with private land. No clearing would be required for the access through

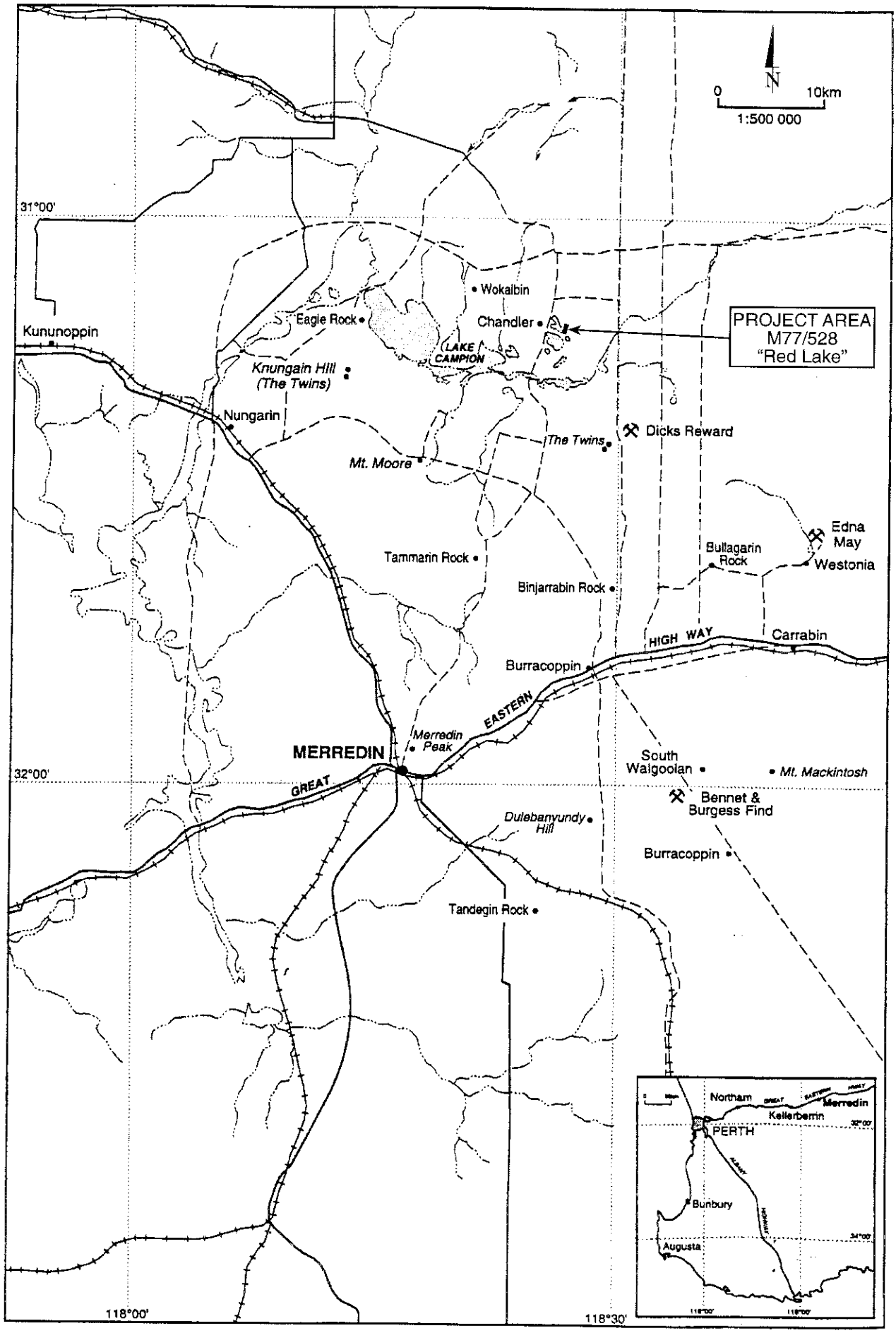

Figure 1. Locality Plan showing Red Lake in relation to Merredin (Freeman, 1994).

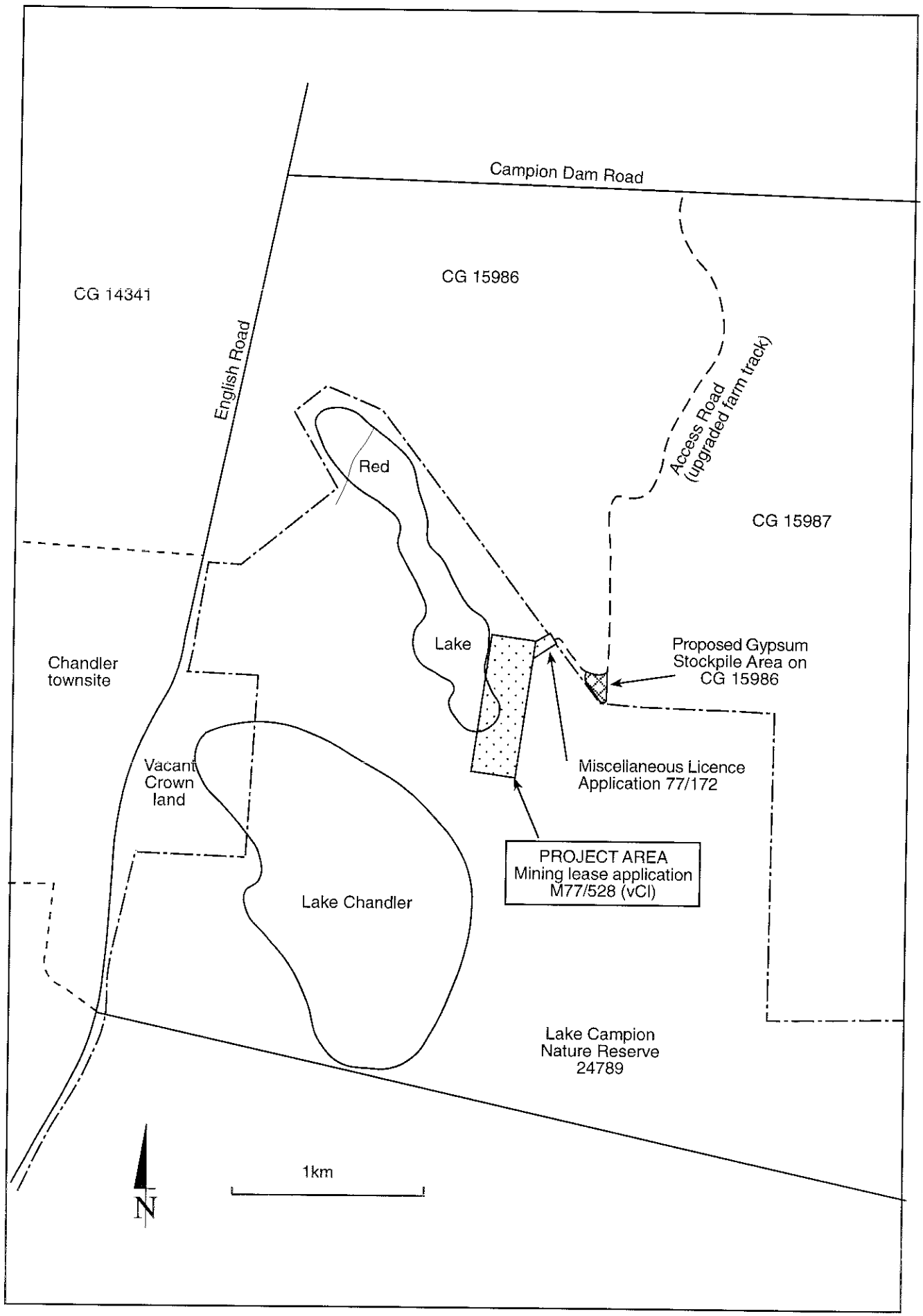

Figure 2. Locality Plan showing the mining lease application in relation to Red Lake (from the proponent's CER).

the nature reserve. It is intended that gravel would be applied to the track to provide traction for vehicles because the soft gypsum substrate is unsuited for vehicle passage.

It is proposed that the base level of mining would slope upwards away from Red Lake to prevent expansion of the lake into the operational area or incursion of saline groundwater. Following mining, topsoil which has been pushed aside prior to mining would be respread together with any vegetation which was previously cleared. A combined seed package of species from surrounding vegetation associations would be used for rehabilitation because the changed soil conditions and removal of most gypsum may favour growth of a different assemblage to the vegetation association presently over the dunes. The CER has proposed the development of an inclined base, at the completion of mining to allow a sufficient margin (at least 1 metre) above saline ground water table, towards the rear of the Mining Lease, for rehabilitation. The CER has stated that this would also allow some gypsum to remain in place and assist in rehabilitation of species which favour the presence of gypsum in the substrate.

The CER states that some of the resulting "subsoil" after mining would be at an elevation closer to that of the samphire association. Consequently, species which occur in that association are the ones which would be preferentially cultivated, though seeds would be collected from all species within the lease area. This veneer of gypsum would be left below the base of mining in an attempt to maximise the regeneration success of the species typical of the present Salt Gum (*Eucalyptus salicola*) woodland association. The CER states that mining of a 10 ha area in M77/528 represents the loss of some 1.3% of the group of vegetation associations within the nature reserve, typically, though not exclusively, developed on gypsum dunes and characterised by *E. salicola* . The remainder of this association is developed, though not exclusively, on gypsum dunes or lunettes in reserves.

The main characteristics of the proposal are summarised in Table 1 below.

Table 1. Summary of key proposal characteristics

Element	Description
Life of project	three to five years
Quantity of gypsum deposit	165,000 tonnes in 11 mining panels
Area of disturbance: total per annum	10 hectares 1-3 hectares
Mining rate: maximum per annum average per annum	45,000t or 3 mining panels (3ha) 30,000t or 2 mining panels (2ha)
Depth of mining	up to 6 metres, conforming to base level sloping upwards from edge of Red Lake; in any event to be at least 1 metre above saline groundwater
Mining setback from Red Lake high water mark	5 metres
Stockpile area on cleared farm land	3 hectares
Mulch and soil storage area	2 hectares
Road access through Nature reserve	0.12 hectare
Gypsum transport as maximum truck movements per week	50 each way, mainly to the stockpile area off tenements on cleared farm land

Since release of the CER, a number of modifications to the proposal have been made by the proponent. These include:

- the method of respreading vegetation and topsoil would be to the requirements of the managing agencies; that is the use of direct return topsoil management.
- an archaeological survey would be conducted for the presence of artefacts of importance to Aboriginal heritage prior to mining; and

- an investigation of the hydrology of the gypsum dunes has been proposed by the proponent with the objective of establishing the height to which subsoil is affected by salt above the level of saline groundwater.

3. Environmental factors

3.1 Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

It is the EPA's opinion that the following are the environmental factors relevant to the proposal, which require detailed evaluation in this report:

(a) Vegetation - loss of significant vegetation

(b) Terrestrial fauna - loss of habitat

(c) Landscape values - effect on landscape values

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the CER document and the submissions received, in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponent's response and commitments. On this basis, the EPA considers that wetlands, lakes, groundwater and Aboriginal heritage factors and other issues raised in the submissions do not require further evaluation by the EPA. The identification process is summarised in Table 3.

The relevant environmental factors are discussed in Sections 3.2 to 3.5 of this report.

3.2 Vegetation - loss of significant vegetation

Description

The proponent's consultant report (Appendix to Aurex, 1998) describes the locality of the project area as follows: Red Lake is a bare salt lake, devoid of vegetation, except where there are narrow *Halosarcia* flats fringing the shoreline. Behind, gypsiferous dunes and silt have accumulated, the dunes being less than 10 m in height. The survey area is surrounded by a nature reserve which in turn is surrounded by extensively cleared agricultural areas where the loss of biodiversity has been high.

Freeman (1990) describes the development of gypsum deposits in the Lake Campion Nature Reserve as a process involving the inflow of saline groundwater to the playa lakes where high evaporation rates produce evaporitic mineral deposits consisting of mostly gypsum and halite with local occurrences of alunite on the playa floors. Evaporites are carried off the dry lake surface by prevailing winds when seasonal conditions are at their driest. Consequently, dune building is favoured only on the side of playa lakes which are leeward shores in hot dry weather. Under these conditions winds generally blow from a north westerly direction.

In the survey area, four vegetation associations were recorded during the field work by the proponent's consultant. *Eucalyptus salicola* open woodland was recorded on the gypsum dunes in the lease area and on similar dunes within the adjacent nature reserve (ie, younger sequence dunes - see below), and *Eucalyptus melanoxylon* open woodland on the red sand rises behind the dunes. The samphire association fringing the lake was a monoculture of *Halosarcia lylei*. No Declared Rare or Priority Listed flora species were located within the survey area. Within the project area is an area of between two and three hectares which was previously mined between 20 and 30 years ago. No rehabilitation was attempted for this area and recolonisation by the surrounding vegetation has been poor since mining ceased; most of the mined area remains bare with occasional shrubs.

The proponent's CER states that a total of 91 plant species were recorded in the survey area located mostly over the younger dune system. A total of 8 weed species were identified predominantly in the previously mined area and along tracks through the lease. Generally, the vegetation is very open at ground level with occasional dense shrub thickets. The vegetation community which is proposed to be removed for gypsum mining is described by the proponent's consultant as Association 1.2 consisting of low woodland over open to dense low shrubland which equates with the Ws2 *Eucalyptus salicola* and *Callitris glaucophylla.* vegetation association described by Coates (1990) in her survey of the Lake Campion Nature Reserve.

As noted by the proponent's consultant, Vegetation Association 1.2 is restricted to dunes on the south and eastern shores of some large salt lakes consisting of quartzose and gypsiferous soils. *Darwinia drummondii* and *Astroloma epacridis* are found predominantly on the lake-side of the dunes.

The project area represents approximately 7.5% of the *Eucalyptus salicola/Callitris glaucophylla* vegetation type (estimated from Ws2: Coates, 1990) within the nature reserve.

Research undertaken by Mattiske (1996) and Coates (1990) indicates that the vegetation of the Lake Campion Nature Reserve consists of unique associations which are dependent on gypsum substrates and which are unlikely to be found elsewhere. Mattiske indicates the value of vegetation within the Lake Campion Nature Reserve in terms of specific adaptation to gypsiferous soils surrounding playa lakes; any specific plant community is likely to be unique to a given lake. More specifically Freeman (1990) has shown soil types at Lake Campion Nature Reserve to vary from one dune to another within each lake system. A total of 229 plant species were reported by Coates in the Lake Campion Nature Reserve (Coates, 1990). Mattiske estimated that approximately 11% of the total plant species found on lake verges may require gypsum, another 4% may prefer it and about 33% tolerate gypsum in the soil.

Lake Campion Nature Reserve, although dominated by bare salt lakes, represents a particularly large and diverse assemblage of natural ecosystems in a region which has been severely over-cleared. In October 1993, within the greater Natural Resource Zone 62, which is in the Avon River Drainage Division (EPA, 1993), less than 7% of native vegetation was left on private land.

The Department of Conservation and Land Management (CALM) and the Conservation Council have advised that it is unlikely that the vegetation of the project area can be satisfactorily restored following mining due to the unique root-zone requirements of each plant species in gypsiferous subsoils. The existing vegetation (Low *Eucalypt/Callitris* woodland over low shrubs) is likely to be replaced by more salt-tolerant species with a consequent loss of biodiversity. Due to the unique nature of vegetation communities growing on gypsum substrates, the area to be cleared could represent a significant proportion of the remaining community of that type. Consequently, due to the uncertain outcome of rehabilitation, decisions regarding any proposal to clear this type of vegetation should be subject to extreme caution.

The Wildflower Society has expressed concern that the EPA is assessing this proposal to clear remnant vegetation in a shire where there is less than 20% remnant vegetation.

Assessment

The area considered for assessment of this vegetation factor is the Lake Campion "C" Class Nature Reserve, vacant Crown land subject to the Mining Lease application and surrounding agricultural region.

The EPA's objective in regard to this environmental factor is to maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities in the Lake Campion Nature Reserve and its surrounds.

The EPA considers the following matters are relevant to its assessment:

1. The EPA has previously considered the success or otherwise of rehabilitation attempts in gypsum dune strip-mining operations (EPA, 1994), noting in particular the rehabilitation of the Kondinin Salt Marsh Nature Reserve following strip mining for gypsum. In the assessment of the rehabilitation of gypsum mining at the Kondinin Nature Reserve, the EPA concluded that the evidence from Kondinin "*indicates that, whilst a diverse range of plants can be established following mining, the vegetation association is markedly different from the original species composition and reflects a severely disturbed habitat, often dominated by a limited number of plant species, including an increased number of weeds*". Mattiske (1996) has also noted the poor prospects for rehabilitating gypsum strip-mining projects.

2. Gypsum dunes provide a refuge, above the influence of saline groundwater, for remnant vegetation in salt-affected landscapes. Mattiske (1996) has noted that the elevation of many gypsum deposits places them well above the saline water table and it is likely that they are physical refuges in the face of increasing land salinisation. Regrowth of salt-intolerant vegetation after strip-mining would be determined by the amount of root-zone which remains above saline affected subsoil. A previously mined area within the project area has not exhibited any significant re-colonisation by natural vegetation over 20 to 30 years post-mining. The poor recolonisation, which could be due to a combination of several factors, is not fully understood. These factors could include a combination of salinisation of the subsoil, loss of soil biota, loss of shade or loss of fresh water storage capacity within the dune.

3. Clearing prior to strip mining would further reduce remnant vegetation in the local region if the original vegetation cannot be restored. Various publications provide statistics and information that indicate the severity of clearing in the greater region of the project area:

   (a) Allison *et al* (1993): In October 1993, less than 7% of native vegetation was left on private land in Natural Resource Zone 62 which includes the project area (Figure 3). The percentage of remaining uncleared land at present is likely to be less than the 7% estimation of the publication dated 5 years ago.

   (b) Thackway and Cresswell (1995): In the Avon Wheatbelt region less than 1% of the native vegetation has been set aside for conservation (Figure 4).

   (c) Beeston *et al* (1995): This publication provides an inventory of uncleared land in each of the southern agricultural shires in 1995. The areas remaining in the Shire of Nungarin are indicated in Table 2 below. Vegetation protected on public land (reserves, vacant Crown land, commons, proclaimed town sites not used) represents a total of 9.7%. A total of 15.8% remains as a combination of remnant vegetation on private land and public land. Scattered and modified vegetation (in many cases overstorey with no understorey) cannot be considered as having conservation value compared with intact remnant vegetation. The percentages for private land is likely to have been reduced since this information was published.

Table 2. Inventory of uncleared land in the Shire of Nungarin
extracted from Beeston et al (1995)

	Remnant	Scattered	Modified
Private Land	6.1%	1.3%	1.7%
Public Land	9.7%		
Total	15.8%	1.3%	1.7%

   (d) The state of the Environment Report (1998) for WA indicates that land clearing in Western Australia has :

   - directly resulted in all three of the highest priority environmental issues facing Western Australia; these include land salinisation, maintaining biodiversity and the salinisation of inland waters;

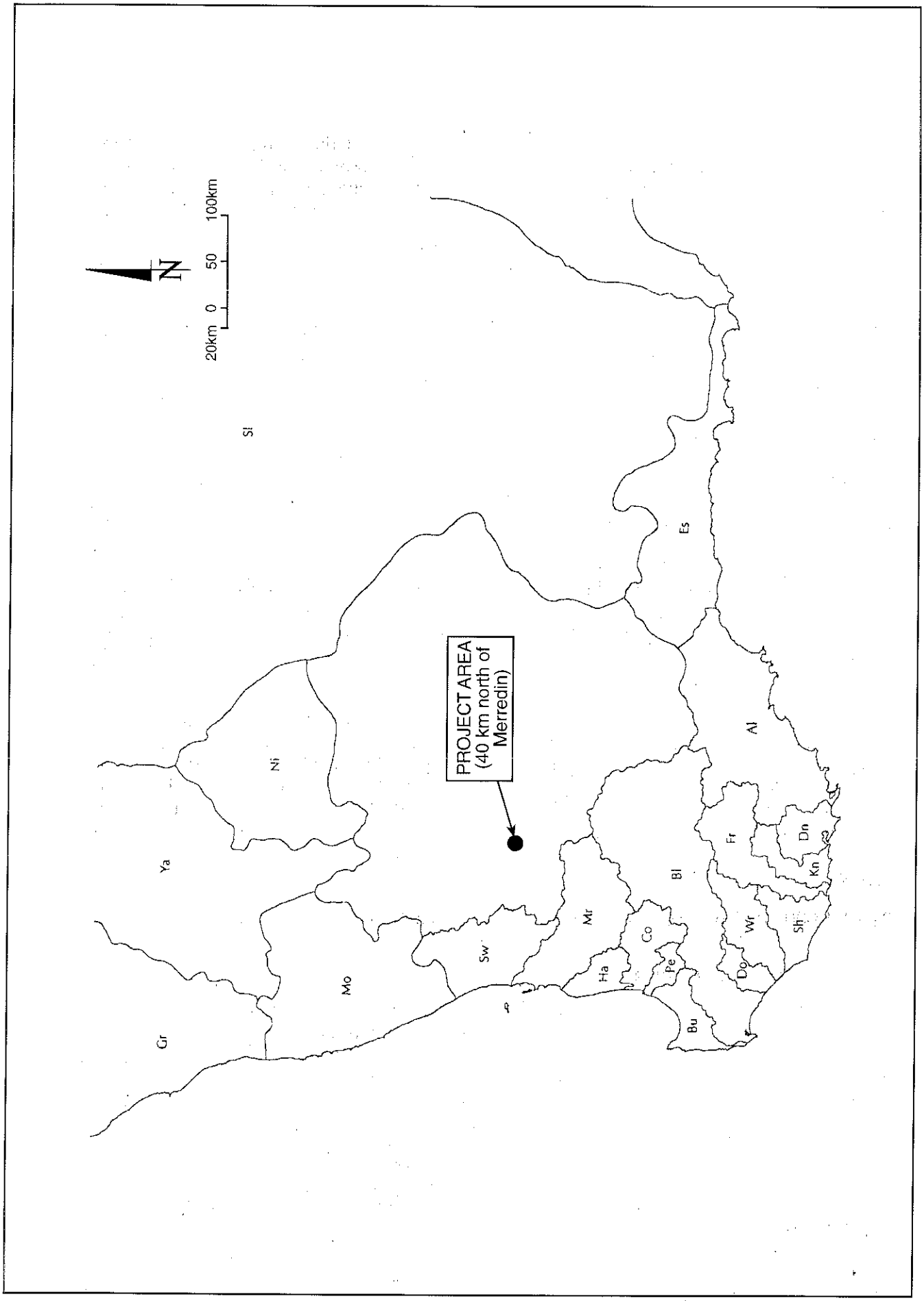

Figure 3. Natural Resource Zones of the South West Land Division (Allison et al, 1993).

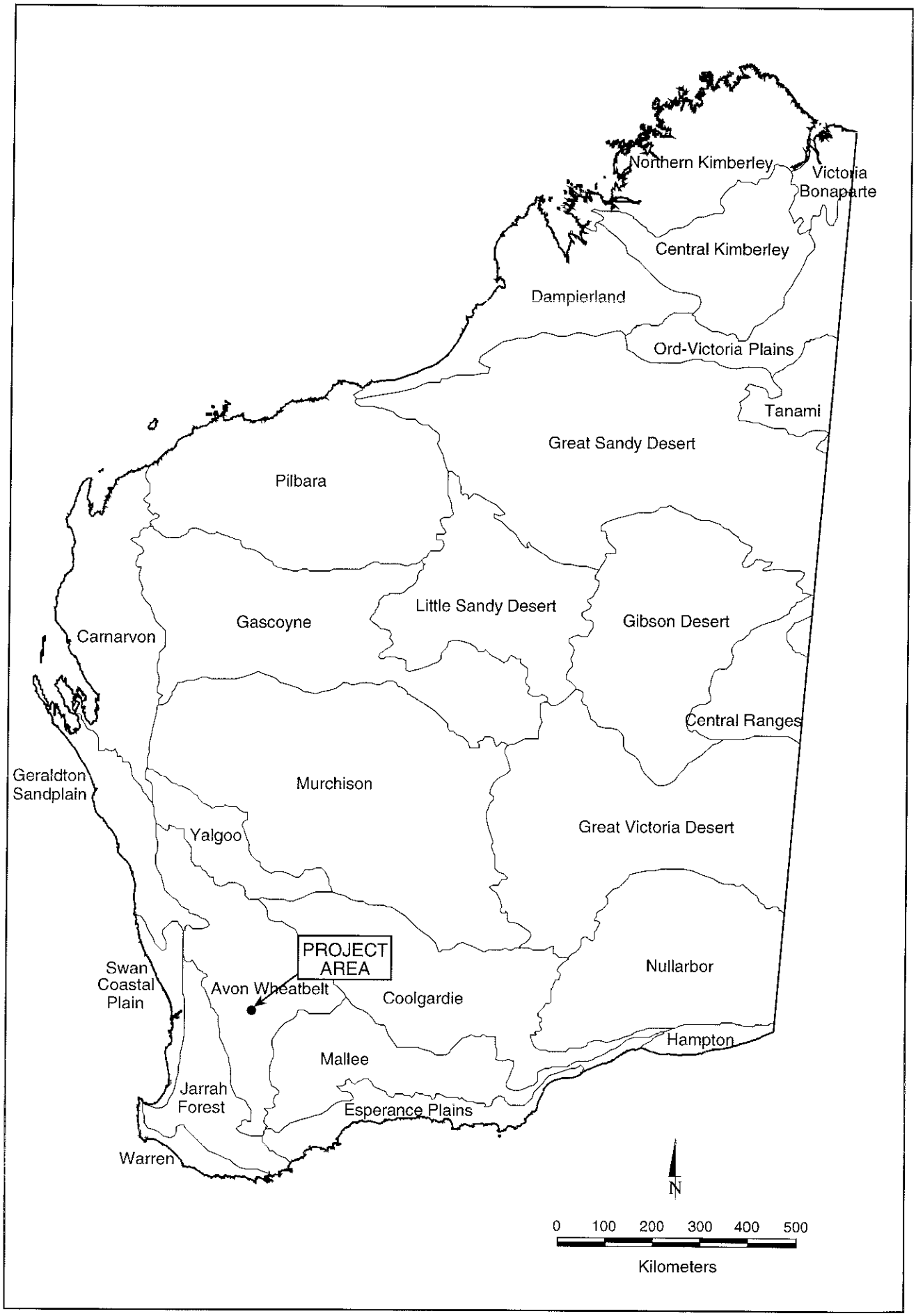

Figure 4. Boundaries of IBRA Regions showing Avon Wheatbelt Region (Thackway & Cresswell, 1995).

- contributed to four of the six environmental issues which have been listed in the second level of priority (greenhouse effect, erosion, eutrophication and loss of fringing vegetation to rivers); and
- contributed to three of the remaining 11 most important environmental issues on the third and fourth level of priority (contamination of inland waters, sedimentation and water logging of soils).

4. Vegetation surveys of the Lake Campion Nature Reserve and plant communities elsewhere on gypsum soils indicate the uniqueness of the plant communities bordering the playa lakes. Mattiske (1996) concluded that the mining of gypsum would remove the specific habitat of about 15% of plant species. Coates (1990) concluded that the *E.salicola* communities (as found in the project area) are the richest community found on gypsum dunes within the nature reserve, with forty species found in gypsum dune communities at Lake Campion Nature Reserve not being found elsewhere. Forty-five of the plant species identified by Coates were only found on dunes, this being 20% of all native plant species listed for the reserve and adjacent areas. Mattiske (1996) notes that among common gypsophilic species there are few that occur across biogeographical regions; that is, many are restricted in locality. It is likely that a particular gypsum area will have vegetation which is not necessarily interchangeable between localities and is less likely to be interchangeable between regions. Other species located adjacent to or between gypsum deposits on ecotones between gypsum and other soils require the maintenance of adjacent habitats, including the dunes, for their survival.

5. Although a professional flora survey has been conducted according to accepted standards for this proposal (Aurex, 1998), a degree of uncertainty regarding undetected species remains; as with previous surveys regarding extant species within the project area. The survey of the vegetation association (Ws2), which includes the project area, by Coates (1990) did not detect 15 species previously recorded (Coates 1990). For this community type, Coates recorded 124 species overall. The proponent's consultant recorded 58 species for the Coates Ws2 community within the 10 ha project area. Biological surveys have thus not been able to establish the status of all flora and fauna species. In view of the lack of detailed knowledge, the protection of the remaining habitat in the Wheatbelt is critically important to retain biodiversity (Remnant Vegetation Steering Committee, 1991).

6. In response to a Government directive that all natural resource conservation issues be considered before any further clearing takes place on private land, an "MOU for the Protection of Remnant Vegetation on Private Land in the Agricultural Region of WA", was agreed in March 1997 by the six main agencies and authorities with statutory responsibilities for control of land and water degradation and the protection of native vegetation. The MOU includes a set of principles and criteria for the environmental evaluation of native vegetation in the Wheatbelt (Safstrom and Craig, 1996), which are adopted by the EPA in the assessment of land clearing generally. Guidance principles which are relevant to this proposal for the assessment of clearing of native vegetation are given below (guidance principles applying to fauna and landscapes are included in the sections below):

Native vegetation should be retained if:

(a) *The land is an inlier to areas reserved for conservation:* The project area is located on vacant Crown land surrounded by the Lake Campion Nature Reserve and consequently is an inlier to land which has been set aside for conservation,

(b) *The land contains or is likely to contain threatened plant communities.* The plant communities are threatened by gypsum mining applications. English and Blyth (1997) have listed plant communities for inclusion on the Threatened Ecological Community (TEC) Database. The gypsum dune vegetation associations (including the Lake Campion Nature Reserve) are listed with the provision given that there is at present insufficient information to distinguish discrete community types against criteria for TECs.

(c) *The land contains areas of very high species richness.* (Refer to para 4 above) Coates (1990) concluded that the *E.salicola* communities (as found in the project area) are the richest community found on gypsum dunes within the nature reserve, with forty species found in gypsum dune communities at Lake Campion Nature Reserve not being found elsewhere. Forty-five of the plant species identified by Coates were only found on dunes, this being 20% of all native plant species listed for the reserve and adjacent areas.

(d) *The land includes vegetation communities not well conserved in the region compared with the original cover as represented in the 'Interim Biogeographical Regionalisation for Australia' (Thackway and Cresswell, 1995)*: The surrounding region has been extensively cleared, consequently the vegetation is not well represented in the greater region.

(e) *The land proposed to be cleared is part of a larger area of uncleared land. Large areas have higher conservation values, the maximum possible area of a remnant should be retained*: The proposal is to clear vegetation in a relatively large area which has either been reserved or is uncleared due to its tenure.

Having particular regard to the:

1. lack of success with previous rehabilitation of gypsum strip mining projects, where the EPA has noted that, whilst a diverse range of plants can be established following mining, the vegetation association is markedly different from the original species composition and reflects a severely disturbed habitat;
2. lack of any additional information demonstrating acceptable rehabilitation of gypsum strip-mining operations;
3. small percentage of remnant vegetation which remains within the Shire of Nungarin and the even smaller percentage which is protected within nature reserves or national parks;
4. high conservation status accorded to plant communities on gypsum soils within the Lake Campion Nature Reserve;
5. degree of uncertainty that unknown flora could exist within the project area; and
6. guidance provided by the "MOU for the Protection of Remnant Vegetation",

it is the EPA's opinion that the proposal is unlikely to provide the conditions which would allow the existing vegetation community to regenerate. This would reduce the representation of the plant community presently found within the Lake Campion Nature Reserve and surrounds with a consequent reduction in biodiversity, and thus not meet the EPA's objective for vegetation.

3.3 Terrestrial fauna - cumulative impacts of loss of habitat

Description

The present state of vegetation of the greater region in which the project area is located is reviewed in Section 3.2 above. Natural fauna habitats are restricted to the presence of remnant vegetation which in the Wheatbelt consists of islands of remnant vegetation in a greater region where less than 1% of vegetation has been set aside for conservation (Thackway and Cresswell, 1995) and where 5 years ago only 15.8% of natural vegetation remained in the Shire of Nungarin (see Table 2). The continuing survival of certain species in the Wheatbelt, which have wide ranging habits or migrate seasonally to exploit various food sources, is dependent on a patchwork of remnant vegetation islands in an extensively cleared landscape. The vegetation remnants provide islands of refuge for breeding and feeding or else corridors or 'stepping stones' which facilitate movement across the landscape (Safstrom and Craig, 1996). The survival of species which are unable to move across cleared landscapes are dependent on larger remnant vegetation stands. This is because continuing survival in smaller stands of vegetation is unlikely in the long term due to the inability of the species to recolonise after extended drought or fire or the likelihood of habitat loss due to invasion by weeds.

The State of the Environment Report (1998) for Western Australia states that land clearing, with the added impacts of introduced species, has resulted in a substantial reduction in biodiversity. The Wheatbelt has had the largest number of extinctions (including 9 or more mammalian species) occurring in Western Australia since European settlement (SOE Reference Group, 1997) and 8 or more terrestrial vertebrate species which are presently of endangered status.

The proponent's fauna consultant (Appendix to Aurex, 1998) notes that the fauna of the Wheatbelt region has been severely affected by a number of factors, particularly native vegetation clearing with the consequence that any remnant vegetation is of conservation significance for native fauna. According to the proponent's consultant, the Lake Campion Nature Reserve supports an almost complete vertebrate assemblage expected for the region, with the exception of nine species now extinct in the Wheatbelt (Aurex, 1998; Appendix F). The number of species likely to be found within the reserve may be accounted for by its relatively large size and the mosaic nature and variety of habitats (Coates, 1990). The majority of species present are of regional significance because of the high loss of natural vegetation in the region. Species of significant conservation value which could possibly be present are the Chuditch and the Red-tailed Phascogale, although neither of the species has been recorded locally in recent years. The latter species are not listed by the consultant as those species 'expected for the region'. The Phascogale is associated with she oak woodlands not present close to the project area and the Chuditch occurs in a wide range of habitats where hollow logs and trees are present.

The proponent's fauna consultant concludes that the small area of loss would be temporary if adequate rehabilitation was carried out after mining; the consultant stating that the gypsum dune in particular is considered to be of low value for fauna compared with adjacent areas. However, the consultant expresses concern that the removal of the dune may adversely impact on adjacent habitats presently in the leeward side of the dunes in the proposed project area. This is because vegetation in the lee of the proposed project area is presently sheltered from hot dry winds blowing off Red Lake by the dunes and vegetation proposed to be removed for this project.

Assessment

The area considered for assessment of this factor is the Wheatbelt of Western Australia.

The EPA's objective in regard to this environmental factor is maintenance of the abundance, species diversity and geographical distribution of terrestrial animals which includes mammals reptiles and birds.

It is the EPA's opinion that the present status of vertebrate species in the Wheatbelt region is related as much to the effect of cumulative impacts of clearing as to the loss of specific habitats. In this regard the fauna related issues which arise in the "MOU for the Protection of Remnant Vegetation on Private Land in the Agricultural Region of WA" are given below:

Native vegetation should be retained if:

1. *The land provides a corridor or stepping stone between areas of conservation:* As assessed in Section 3.2 above, the project area is located in a larger reserve of remnant vegetation which in turn is part of a patchwork of remnant vegetation over the greater Wheatbelt region. The reserve in which the project area is located is a significant corridor habitat due to the poor representation of natural vegetation in reserves in the greater region.
2. *The land has significance as habitat for wildlife or if a loss of diversity by clearing part of the land will adversely impact on fauna dependent on a mosaic of vegetation types*: The land is a significant wildlife refuge in that due to its size and diversity of habitats it is likely to have an almost complete assemblage of expected species. Coates (1990) has commented on the mosaic nature of habitats within the Lake Campion Nature Reserve.

Removal of gypsum dunes and vegetation in an area within the nature reserve could add to cumulative impacts on the fauna biodiversity of the reserve and on remnant vegetation in

regional terms in its capacity to provide sufficient habitats and migratory routes across the Wheatbelt which at present maintain the biodiversity of the region.

Having particular regard to the cumulative impacts of clearing on fauna habitats in the Wheatbelt of Western Australia, it is the EPA's opinion that the proposal has the potential to adversely impact on the biodiversity of fauna in the Wheatbelt and consequently cannot meet the EPA's objective for fauna.

3.4 Landscape - effect on landscape values

Description

The majority of Western Australia's gypsum deposits are related to salt lakes in the arid interior of the State. These are found in a broad band from Geraldton in the north west to Albany and Esperance in the south east encompassing most of the Wheatbelt and the drier regions which lie on the eastern margins of the Wheatbelt (Jones, 1994). During the time of agricultural expansion for wheat farming, these playa lakes were not always included in land grants due to their unsuitability for agriculture. As a consequence, approximately 30% of nature reserves in the Wheatbelt are associated with salt lakes or saline drainage systems (Coates, 1990).

Red Lake, which is part of the Lake Campion Nature Reserve, consists of an extensive salt lake which is fringed by samphires on the lake margins with a series of dunes rising beyond the edges of the high water mark. Shrublands develop on the slopes of dunes with mixed woodlands on higher ground. Coates (1990) has described the surrounding landscape as a saline drainage system which is a mosaic of vegetation types associated with small topographical changes. The vegetation over the dunes is dominated by mixed *Eucalyptus* open woodland over a scattered understorey of shrubs. The dominant species composition differs from dune to dune on the basis of age and physical composition of the dune. These woodlands thus provide a varied landscape where up to 13 eucalypt species (Coates, 1990), with different crown structures and heights, form a backdrop to the lake.

Although an area of between 1 and 2 ha on the edge of Red Lake has been previously strip-mined for gypsum and has shown very poor colonisation by the surrounding vegetation, this area is confined to the rear of the foredunes and has a backdrop of tall *Eucalyptus melanoxylon* and *Eucalyptus yilgarnensis* woodlands on older dunes to the rear; consequently the small unrehabilitated former mining area is not obvious either as a break in the fringing dunes or as a gap in the woodland backdrop to the margins of the lake.

"Reading the Remote" is a study of aesthetic characteristics of typical West Australian landscapes, published by CALM in 1994, for the purpose of landscape planning and management (CALM, 1994). The study provides three levels (high, moderate, low) of scenic value which may be associated with landforms, vegetation and waterforms according to scenic quality. Within the classification system of this study, the Red Lake project area is located within the "Merredin Plateau Sub-Type". Within this system "Trees with some diversity of species, height and density eg wetland fringes" is accorded "high" scenic quality. Similarly "All lakes, rivers, streams and wetlands, permanent or intermittent ..." are also accorded "high" scenic value. Consequently the natural landscape and vegetation features of Red Lake are of "high" scenic value according to the criteria of "Reading the Remote" which was developed by CALM.

Assessment

The area considered for assessment of this factor is the Lake Campion Nature Reserve.

The EPA's objective in regard to this environmental factor is the establishment of stable, sustainable landforms in the post-mining phase which are consistent with the surrounding landscape.

As with any resource which has been depleted, it is the EPA's view that the intrinsic value of the remnants are enhanced in inverse proportion to the fraction that remains. This principle may apply to "resources" such as minerals, the heritage value of buildings constructed before 1920

in the Central Business District or to the inherent scenic and landscape heritage values of Red Lake compared to the large scale depletion of natural values which land clearing has removed in the surrounding Wheatbelt (Beeston *et al,* 1995). Consequently it is the EPA's opinion that Red Lake has both high scenic and landscape heritage value due to the depletion of similar landscape characteristics in the greater region due to clearing of native vegetation. This view is supported in heritage issues arising from the "MOU for the Protection of Remnant Vegetation on Private Land in the Agricultural Region of WA". In particular the MOU provides the following guidance in regard to land clearance where heritage issues are concerned:

Native vegetation should be retained if the land provides high landscape values or heritage value: the project area being located within a natural landscape which has outstanding scenic and heritage value in a surrounding region which has been severely depleted of natural values due to clearing.

It is of concern to the EPA that removal of gypsum dunes and vegetation in an area enclosed within the nature reserve would impact on the heritage and natural landscape values of the reserve as a whole.

Having particular regard to the:

1. potential impact on landscape values by the proposed removal of 600m of dunes and associated vegetation community of woodland from the edge of Red Lake; and
2. high heritage and landscape value of Red Lake due to its location in a greater region which has been severely depleted of natural values by land clearing,

it is the EPA's opinion that the proposal has the potential to adversely impact on the high landscape values of the Red Lake surrounds which are an integral part of Lake Campion Nature Reserve and consequently cannot meet the EPA's objective for landscape.

4. Other Advice

The importance of gypsum to agriculture

This information is provided as a background to the conflict between the requirements of conservation and agriculture over decisions regarding use of public land in the Wheatbelt of Western Australia and did not form part of the environmental impact assessment for this project. However, these are important issues to be considered for the purpose of broader policy development for gypsum resource management in Western Australia.

The "Lake Chinocup Report" (Montgomery, 1994) is a collection of papers published by Agriculture WA presenting research information on the treatment of certain "problem" soils with gypsum. The overview by Montgomery (1994) provides the following synopsis. "*In the southern Wheatbelt of Western Australia, there are substantial areas of heavy soils, known locally as moort soils and collectively called hard-setting grey clays. These soils are difficult to cultivate, crop emergence is poor and yields are generally low. Cultivation and puddling by stock quickly break down the structure of these soils which makes them prone to water-logging, even more difficult to work and less productive.*" (Montgomery, 1994).

The "cultivation and puddling" referred to by Montgomery are the traditional practices of ploughing and the consequences of allowing stock to feed on stubble; in both cases the mechanical effects of either soil rotation or stock trampling result in a degraded soil structure (reviewed by Moore *et al,* 1994). Publication of trials by Agriculture WA indicate that gypsum application to such soils ("gypsum-responsive soils") will ameliorate degraded soils and effect a substantial increase in crop yields (Jones, 1994). The possibility of these benefits being facilitated by cheap gypsum available from public land (Smith *et al,* 1994), is a persuasive argument to those frustrated by ownership of degraded soils. There is also an underlying assumption that increased productivity would provide the resources for farmers to place greater effort into more sustainable land management practices (Montgomery, 1994).

Controversy arises when access to public land for mining is questioned on conservation grounds, regardless of the conflicting notion that the remnants of uncleared land are being threatened by the laudatory motivation to rehabilitate the results of land clearing. Gypsum is available elsewhere (Jones, 1994) but the existing price structure offers little incentive to landowners to allow mining of privately owned resources (see discussion next bullet point). The incentive to allow access to private resources would include sufficient compensation for removal of the resource as well as adequate mining rehabilitation; the present price structure apparently not being sufficient to meet these two requirements.

Although the treatment of "gypsum-responsive soils" may result in substantial yield increases, these soils will revert to their previously degraded status unless "best-practice" farm management techniques are employed; thus sustainability can only be achieved where gypsum application is only one of several management tools. Best-practice requires careful management of nitrogen application drainage, herbicide-mediated weed control, crop rotation, revegetation strategies, and use of minimum tillage techniques which require specialised equipment (Sweeney, 1994).

Howell (1987) reviews trials conducted in the Wheatbelt to determine the effects of conventional tillage and direct drilling with and without the application of gypsum. The study shows that "*... gypsum does not create good soil structure, it merely stabilises it. The response from applying gypsum is not permanent and only lasts while gypsum is present. Tillage practices must be altered to a minimum tillage system and ideally to direct drilling*". The review concludes that long-term soil stability will not be achieved by use of gypsum alone.

Other factors which are canvassed outside of the environmental impact assessment process by agricultural interests include the regional economic benefits of exploiting gypsum on public lands which are available at low economic cost, the complex issues surrounding alternative gypsum supplies and the costs to the farmer of implementing best-practice farm management. These are important "non-environmental" factors which have environmental impacts.

- **Comment by Government and other agencies**

CALM has advised that until a State Gypsum Supply Strategy is developed for the supply of gypsum, public land will continue to be targeted until gypsum within nature reserves and national parks has been exhausted. This would have an unacceptable impact on the landscape values and the unique remnant vegetation associated with these dunes. It is suggested by CALM that public lands are seen as a resource for gypsum because there is insufficient reward for landowners to mine gypsum on private land.

The Conservation Council, CALM and the National Parks & Nature Conservation Authority have expressed concern about cumulative impacts on nature reserves. CALM has advised that Lake Campion Nature Reserve is under "extreme" threat from mining. The Lake Campion Nature Reserve (Figure 5) has an overlapping patchwork of mining lease applications. There are two granted mining leases which would only require a change of conditions to exploit gypsum dunes, following due process. Consequently a holder of a granted mining lease would have a high expectation of gaining approval to mine, especially if the present ungranted lease application were to be successful.

CALM is concerned that each gypsum mining proposal that is approved within the national estate has the potential to heighten expectation of further approvals, especially where granted mining leases are concerned.

As a matter of inter-generational equity, the DEP is concerned that the natural resources of the State need to be distributed on an equitable basis (State of the Environment Reference Group, 1998). In the Avon Wheatbelt region less than 1% of the native vegetation has been set aside for conservation (Thackway and Cresswell, 1995). This is a pressing reason why the needs of agriculture should be met from the already extensive land resources already set aside for agriculture rather than depleting or degrading the remaining areas set aside for conservation. At present there is little information and little incentive to determine the nature and extent of gypsum deposits which exist on land which has already been allocated for agriculture.

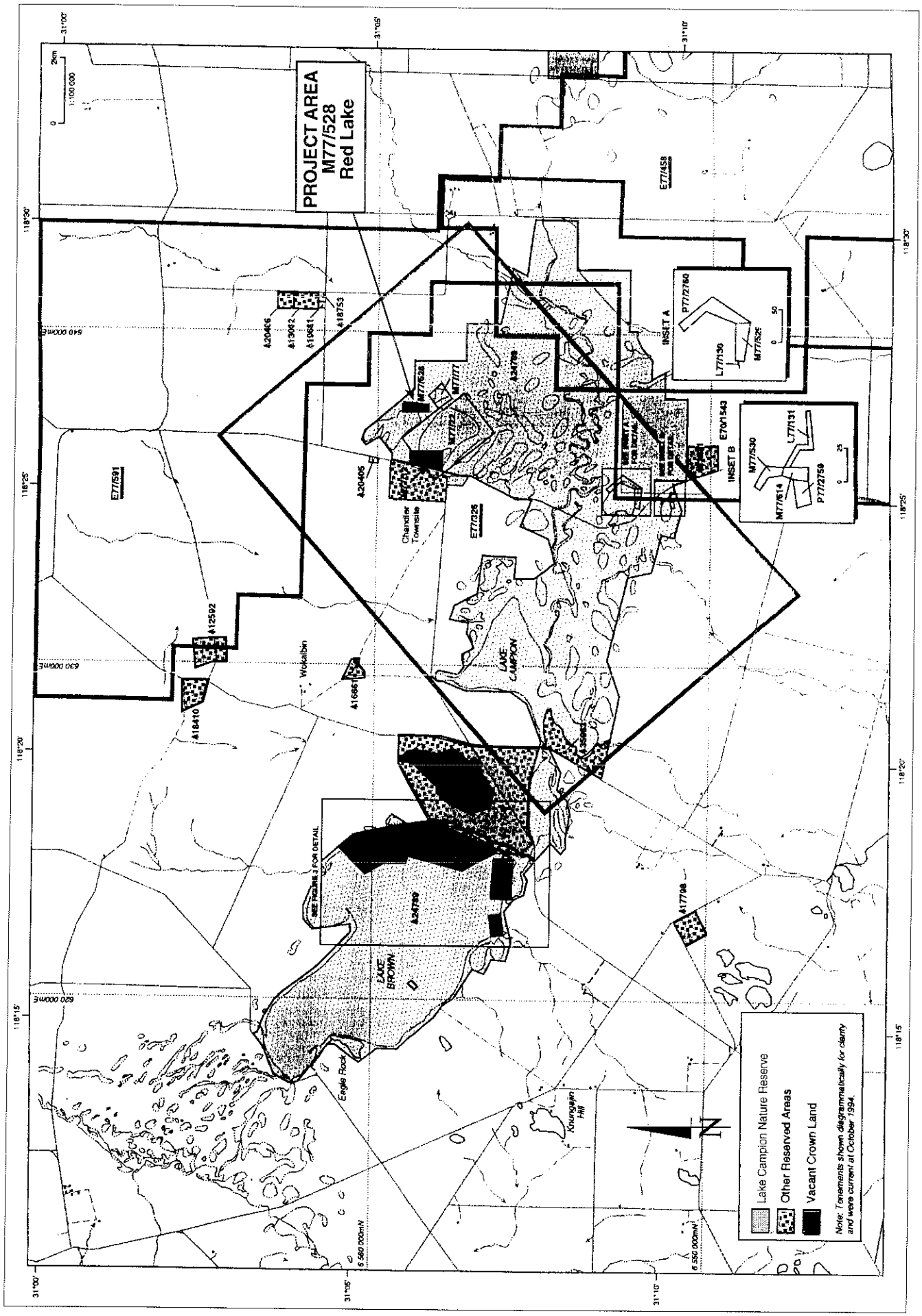

Figure 5. Extent of Lake Campion Reserve and other reserves in the locality of Red Lake (Freeman, 1994).

The strategies, policies and statements of the International Convention on Biological Diversity (to which Australia is a signatory), NP&NCA, CALM, the Soil and Land Conservation Council of WA, the Select Committee into Land Conservation (1991), the Remnant Vegetation Steering Committee (1991) and the MOU between key Government agencies regarding clearing of vegetation in the agricultural region of Western Australia (1997) all conclude that land degradation and associated environmental impacts of salinisation and loss of biodiversity have resulted from land clearing. Consequently the EPA considers that projects which have the potential to adversely impact on publicly owned land within regions which have been over-cleared should not be approved.

As a consequence of:

1. the significant environmental values of the Lake Campion Nature Reserve and publicly owned adjoining uncleared land;
2. the large number of mining lease applications which cover the Lake Campion Nature Reserve and adjoining publicly owned land;
3. the granted mining leases which only require due process for the conversion of conditions to permit mining; and
4. the lack of information regarding alternative gypsum resources,

the EPA recommends the development of a State Gypsum Supply Strategy for the orderly supply of gypsum to ensure that vegetation and ecosystems on public land is protected. In particular, the vegetation on gypsum dunes is in need of particular attention for conservation needs. It should be noted that the EPA is presently preparing guidance notes for assessing gypsum mining proposals, so that proponents and government agencies will be aware of the EPA's position on such proposals.

5. Conclusions

The EPA has considered the proposal by Aurex Pty Ltd to strip-mine gypsum at Red Lake on vacant Crown land enclosed by the Lake Campion C-Class Nature Reserve.

It is the EPA's opinion that the proposal is unlikely to be successful in restoring the existing vegetation within the proposed project area due to the unique local soil conditions to which the vegetation community is adapted. Replacement of unique vegetation associated with the dune system with more common salt-tolerant vegetation on dune remnants would result in a reduction in biodiversity of the region.

Although rare or declared flora were not found to be present within the project area, the EPA considers that, given the unique nature of gypsophilic and gypsum-tolerant plant communities which differ according to individual dunal substrates, considerable caution should be exercised in considering an application to clear such vegetation, especially in regard to the probability that some species may yet be undetected.

The EPA notes that extensive clearing of native vegetation has already occurred in the greater region of the project area. In the Avon Wheatbelt region less than 1% of the native vegetation has been set aside for conservation (Thackway and Cresswell, 1995). In the Shire of Nungarin where the project is located, only 9.7% of uncleared or unmodified vegetation is protected on publicly owned land (Beeston *et al* 1995).

Accordingly, the EPA has concluded that proposal cannot be managed to meet the EPA's environmental objective for vegetation.

Although rare fauna are not likely to be found within the project area, the EPA considers that the project is likely to contribute to cumulative impacts on fauna biodiversity within the reserve and also the greater region in which the reserve is located.

It is the EPA's opinion that the proposal has the potential to adversely impact on the natural features of the Red Lake and its surrounds, particularly the surrounding nature reserve which has high landscape and heritage values. Consequently the EPA has concluded that the proposal cannot meet the EPA's objective for maintaining landscapes which are compatible with their

surrounds, especially in a region which has been severely depleted of natural values through clearing of native vegetation.

The need for access to gypsum for soil remediation purposes in some areas of agricultural land has been considered by the EPA. There have been discussions within government agencies about the need for a strategic examination of the resource, its availability and constraints, and what additional measures are required to ensure that the use of gypsum is supported by the best agricultural practice. The EPA supports the preparation of a State Gypsum Supply Strategy.

6. Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors of vegetation, terrestrial fauna and landscape values as set out in Section 3.
2. That the Minister notes that the EPA has concluded that the proposal cannot meet the EPA's environmental objectives and cannot be managed in an environmentally acceptable manner, such that the biodiversity of the Lake Campion Nature Reserve and its surrounds is not further reduced.
3. That the Minister notes that the EPA has not provided conditions and procedures to which the proposal should be subject because the EPA has concluded that the proposal cannot be managed in an environmentally acceptable manner.
4. That the Minister notes that the EPA is preparing a position statement in relation to mining of gypsiferous dunes which support remnant vegetation communities of high biodiversity value.
5. That the Minister supports the development of a State Gypsum Supply Strategy, similar in scope to the State Gravel Supply Strategy (Main Roads of WA, 1996), such that remnant vegetation communities on gypsum dunes on public land are adequately protected when the requirements for gypsum are considered.

Table 3: Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	RELEVANT ENVIRONMENTAL FACTORS
Vegetation - loss of significant vegetation	• The impact of removing gypsum dunes could be to place the 'rehabilitated' ground surface within the influence of saline groundwater , thus removing the salt-free zone required by salt-intolerant plants. • Likely success of acceptable rehabilitation: Lack of success in rehabilitation would result in a reduction in the representation of this particular community with a consequent loss of biodiversity in a region which has already incurred severe biodiversity losses. • Clearing within the project area could result in the loss of yet undetermined species in an area where vegetation communities are regarded as having high conservation status. • The proposal could result in the further spread of weeds into the Nature Reserve, causing adverse impacts on the vegetation.	• CALM advise that the endpoint of rehabilitation is most likely to be closer to that of a samphire community; that is, the existing mixed woodland over shrubs will be replaced by halophytic species. Consequently CALM has stated a requirement for appropriate rehabilitation endpoints which will not compromise the requirement for maintenance of biodiversity. • CALM and the Conservation Council have advised that it is unlikely that the project area can be satisfactorily rehabilitated. It is agreed in the CER that rehabilitation will move the species composition towards that of a samphire community. Consequently the existing vegetation (Low *Eucalypt/Callitris* woodland over low shrubs) is likely to be replaced by samphire or halophytic species with a consequent loss of biodiversity. • The Wildflower Society has expressed concern that the EPA is considering this proposal to clear remnant vegetation in a shire where there is less than 20% remnant vegetation. This is applicable to the Memorandum of Understanding between key government agencies, 6 March 1997. • CALM's submission has listed environmental problems in the Wheatbelt attributable to land clearing and consequent farm management: salinity, waterlogging, acidification, loss of biodiversity and under-representation of reserves. • CALM and the Conservation Council have advised that, due to the unique nature of gypsiferous vegetation communities, the area to be cleared could represent a significant proportion of the remaining community of that type. • The Wildflower Society has stated that the method of survey (over one day during spring) is inadequate. Even with return visits approximately 10% of the flora could be missed, which could be either rare or unusual species. Consequently, this project could impact on rare species which may occur in the project area but have not been identified. • The Wildflower Society of WA have expressed concern that the EPA consider a proposal to destroy further remnant vegetation in a shire where there is less than 20% remnant vegetation contrary to the spirit of the "MOU for the Protection of Remnant Vegetation". • The Conservation Council have expressed concern that the project will hasten the spread of weeds into the Nature Reserve from surrounding farmland.	*Except for weeds, which the EPA accepts can be managed, all other aspects of this factor are considered to be relevant to the environmental impact assessment.*

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	RELEVANT ENVIRONMENTAL FACTORS
Terrestrial fauna - cumulative impacts on loss of habitat	Removal of vegetation will impact on terrestrial fauna habitats	Removal of vegetation from the project area would contribute to the cumulative impacts on remnant vegetation which has resulted in the loss of habitats in the Wheatbelt. Cumulative impacts have the potential to contribute to the overall loss of wildlife corridors and 'stepping stone' habitats in the Wheatbelt.	*Considered to be a relevant factor.*
Landscape - effect on landscape values	Removal of gypsum dunes and vegetation in an area wholly within the NR will impact on the heritage and natural landscape values of the Reserve as a whole.	The NP&NCA endorses the comments expressed by CALM and is opposed to the proposal on the basis of cumulative impacts likely to be caused by gypsum mining by this and other proposals which are likely to follow. The natural landscape and vegetation features of Red Lake are of "high" scenic value according to the criteria of "Reading the Remote" which was developed by CALM. The nature reserve in its intact state has high heritage value relative to the fact that it is located in a greater region depleted of natural values by extensive vegetation clearing.	*Considered to be a relevant factor.*
Wetlands	Foreshore wetland areas with halophytic vegetation could be adversely impacted by mining activities	The CER states that a defined distance is proposed to be maintained between operations and the high water mark of the Red Lake which includes wetland areas with halophytic plants.	*Factor does not require further EPA evaluation. as proponent commitments are adequate*
Lakes	Mining activities could impact on the integrity, functions or environmental values of Red Lake.	The CER states that a defined distance is proposed to be maintained between operations and the high water mark of the Red Lake.	*Factor does not require further EPA evaluation. as proponent commitments are adequate*
Groundwater	Mining related activities could impact on groundwater quality.	The CER provides adequate provision for hydrocarbon management.	*Factor does not require further EPA evaluation. as proponent commitments are adequate*
SOCIAL SURROUNDINGS			
Aboriginal heritage	Possible impact on heritage sites	The Department of Aboriginal Affairs have advised that although the proponent has contacted native title claimants, a heritage survey should be undertaken prior to the proposal to ensure Aboriginal sites are not impacted.	*Factor does not require further EPA evaluation. as Heritage Act requirements adequately address this issue*

Table 4: Summary of Assessment of Relevant Environmental Factors

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Vegetation - loss of significant vegetation	Lake Campion 'C' Class Nature Reserve, vacant Crown Land subject to the Mining Lease application and surrounding agricultural region	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities. Clearing proposals within the agricultural region of WA should meet the requirements of the "MOU for the Protection of Remnant Vegetation"	• To date no acceptable examples of rehabilitation of gypsum-strip mining have been presented to the EPA. • The subsoil within dunes, which lies above the influence of saline groundwater, provides a refuge for salt-intolerant species. A previously mined area within the project area has not exhibited any significant re-colonisation over 20 to 30 years. • The severity of clearing in the Wheatbelt is indicated by the following statistics: In 1993 less then 7% of native vegetation was left on private land in Natural Resource Zone 62; In the Avon Wheatbelt less than 1% of original native vegetation has been set aside for conservation; In the Shire of Nungarin, only 15.8% of the original vegetation remained in 1995; of this, 9.7% is on public land. • The State of the Environment Report (1998) for WA indicates that 7 of the 9 highest priority environmental issues facing the State are attributable to land clearing which also contributes to 4 of the remaining 11 priority environmental issues. • Clearing within the project area could significantly reduce the representation of this particular community represented by the dominant *E.salicola/Callitris* overstorey. The project area represents about 7.5% of this vegetation locally. • Due to the inherent nature of vegetation survey, a degree of uncertainty exists regarding undetected species. • The following principles from the "MOU for the Protection of Remnant Vegetation" apply to this project: *Native vegetation should be retained if:* *• the land is an inlier to areas reserved for conservation,* *• the land contains or is likely to contain threatened plant communities,* *• the land contains areas of very high species richness,* *• the land includes vegetation communities not well conserved in the region compared with the original cover as represented in the IBRA (Thackway and Cresswell, 1995),* *• the land proposed to be cleared is part of a larger area of uncleared land. Large areas have higher conservation values, the maximum possible area of a remnant should be retained.*	Having regard to: • consideration of previous rehabilitation of gypsum strip mining projects, the EPA noted that, whilst a diverse range of plants can be established following mining, the vegetation association is markedly different from the original species composition and reflects a severely disturbed habitat; • the lack of any additional information regarding acceptable rehabilitation of gypsum strip-mining operations; • small percentage of original vegetation which remains within the Shire of Nungarin and the even smaller percentage which is protected within nature reserves or national parks in the greater region; • the present wide extent of clearing and consequent severe loss of biodiversity in the Wheatbelt; • high conservation status accorded to vegetation in gypsiferous communities within the Lake Campion Nature Reserve; • the uncertainty that unknown flora, which could be of high conservation status, could exist within the project area. • guidance provided by the "MOU for the Protection of Remnant Vegetation" it is the EPA's opinion that the proposal is unlikely to provide the conditions which would allow the existing vegetation community to regenerate. This would reduce the representation of the plant community presently found within the Lake Campion Nature Reserve and surrounds with a consequent reduction in biodiversity of the region and thus the proposal does not meet the EPA's objective for vegetation.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Terrestrial fauna - cumulative impacts of clearing on habitats	Wheatbelt of Western Australia	Maintain the abundance species diversity and distribution of terrestrial fauna	The present status of vertebrate species in the Wheatbelt region is related as much to the effect of cumulative impacts of clearing as to the loss of specific habitats. In this regard the fauna issues which arise in the "MOU for the Protection of Remnant Vegetation on Private Land in the Agricultural Region of WA" which are relevant to fauna issues are: *Native vegetation should be retained if:* • *the land provides a corridor or stepping stone between areas of conservation,* • *the land has significance as habitat for wildlife or if a loss of diversity by clearing part of the land will adversely impact on fauna dependent on a mosaic of vegetation types*:	Having regard to: • guidance provided by the "MOU for the Protection of Remnant Vegetation" and • the cumulative impacts of clearing on fauna habitats in the Wheatbelt of Western Australia, it is the EPA's opinion that the proposal has the potential to adversely affect fauna habitats and consequently the biodiversity of terrestrial fauna in the Wheatbelt. Therefore the proposal cannot meet the EPA's objective for maintenance of abundance, species diversity and distribution of terrestrial fauna.
Landscape - effect on landscape values	Within the Lake Campion Nature Reserve	Establishment of stable, sustainable landforms consistent with surroundings	In regard to landscape values the "MOU for the Protection of Remnant Vegetation" recommends that: *Native vegetation should be retained if the land provides high landscape values or heritage value:* the project area being located within a natural landscape which has outstanding scenic and heritage value in a surrounding region which has been severely depleted of natural values due to clearing. "Reading the Remote" (CALM, 1994) rates the project area as having 'high' scenic value. The activities within the project area have the potential to impact on the landscape values of the surrounding Nature Reserve unless rehabilitation acceptable to the EPA can be achieved.	Having regard to: • potential impact on landscape values by the proposed removal of 600m of dunes and associated vegetation community of woodland from the edge of Red Lake; and • high heritage and landscape value of Red Lake due to its location in a greater region which has been severely depleted of natural values by land clearing it is the EPA's opinion that the proposal is unlikely to be rehabilitated to the requirements of the EPA and consequently has the potential to adversely impact on the scenic and landscape heritage values of the Red Lake surrounds.

Appendix 1

List of submitters

Responses to Public Review of Consultative Environmental Review

Organisations:

Aboriginal Affairs Department
Conservation Council of Western Australia Inc.
Department of Conservation and Land Management
National Parks and Nature Conservation Authority
Wildflower Society of Western Australia (Inc.)

Appendix 2

References

Allison H.E, Brandenburg S.A. and Beeston G.R. (1993). "Natural resource zones of the South West Land Division, Western Australia." Technical Series 55, Environmental Protection Authority, Perth.

Aurex Pty Ltd (1998). CER: "Proposed gypsum mining operations in the area of Mining Lease Application M77/528 and Miscellaneous Licence 77/172. Red Lake, Chandler, Shire of Nungarin". Report to the EPA, Unpublished.

Beeston G., Mlodawski G., True D. and Sanders A. (1995). "Remnant vegetation inventory in the southern agricultural areas of Western Australia." Research Management Technical Report No149. Regional Operations Division of WA Department of Agriculture, Perth.

CALM (1994). "Reading the remote". Department of Conservation and Land Management, Perth Western Australia.

Coates A. (1990). "Vegetation survey of the Lake Campion Nature Reserve No.21759." A report to the Department of Conservation and Land Management, Unpublished.

English V. and Blyth V. (1997). "Identifying and conserving threatened ecological communities in the South West Botanical Province". ANCA National Reserves System Cooperative Program: Project Number N702. National Parks and Wildlife, Environment Australia, WA Dept of Conservation and land Management.

EPA (1994). Mining of gypsum from Chinocup A Class Nature Reserve, Pingrup." Bulletin 737, Environmental Protection Authority, Perth.

EPA (1997). Guidelines: "Red Lake Gypsum Mining, M77/578 and L77/172, 2km East of Chandler, Shire of Nungarin (Assessment No 1155)", Environmental Protection Authority, Perth.

Freeman M.J. (1994). "Gypsum resources and tenements of the Lake Campion Nature Reserve and environs." Geological Survey of Western Australia, Report EV100.

Howell, M. (1987). "Gypsum use in the wheatbelt." J. Ag. WA No 2 pp40-43

Jones D.C. (1994). "Gypsum deposits of Western Australia." Geological Survey of Western Australia, Record 1993/5.

Main Roads of Western Australia (1996). "State gravel supply strategy". Main Roads of Western Australia, Perth, Western Australia.

Mattiske Consulting Pty Ltd. (1996). "Review of botanical values on a range of gypsum dunes in the Wheatbelt of Western Australia. Part D" Unpublished report prepared for Dept of CALM.

Montgomery A.J. (Ed.) (1994) "Potential for increased farm production and improved land management through use of gypsum around lake Chinocup." subtitled "Lake Chinocup Report." Agriculture WA, Perth, Western Australia.

Moore, G., Overheu, T., Percy, H., Dellar, G., Cochrane, H., Proffit, T. and Feldman, J. (1994). "Responsiveness of soils in the area to gypsum." *in* Montgomery (1994a).

Remnant Vegetation Steering Committee (1991). "Issues in remnant vegetation protection in Western Australia." G.A. Robertson, Chairman. Department of Agriculture, Western Australia.

Safstrom, R. and Craig, G.F. (1996). "Environmental evaluation of native vegetation in the wheatbelt of Western Australia. Principles and criteria used to appraise land clearing proposals". Department of Environmental Protection, Perth, Western Australia.

Select Committee Into land Conservation (1991). "Final report presented by Mr M.G.House, MLA, to the Western Australian Legislative Assembly." Legislative Assembly, Perth, Western Australia.

Smith A., Lefroy E. and Bettison A. (1994). "Farmer adoption of best-practice farm management package including gypsum." *in* Montgomery (1994a).

State of the Environment Reference Group (1998). "State of the Environment." Department of Environmental Protection, Perth, Western Australia.

Sweeny T. (1994). "Best-practice farm-management package including gypsum." *in* "Lake Chinocup Report", Montgomery (1994a).

Thackway R. and Cresswell I.D. (Eds) (1995). IBRA - An Interim Biogeographical Regionalisation for Australia: a framework for establishing for the national system of reserves. Version 4.0 Australian Nature Conservation Agency, Canberra.