



2<sup>nd</sup> September 2005

Reference: Response to Submissions transmittal

Dr Walter Cox  
Chairman  
Environmental Protection Authority  
Level 8 Westralia Square  
141 St Georges Tce  
PERTH WA 6000

Attention: Graham Storey (Peter Walkington)

Dear Dr Cox

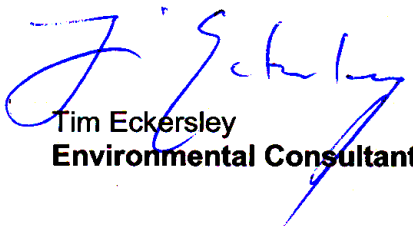
**Worsley Alumina Bauxite-Alumina Project Expansion to 4.4 Mtpa – Assessment No. 1526**

Following the completion of the 10 week public review period (1/8/05) of the Environmental Review and Management Programme for the above proposal, 24 submissions have been received from government agencies, non-government organizations and members of the public.

Worsley Alumina Pty Ltd has provided responses to all submissions in accordance with Environmental Impact Assessment (Part IV Division 1) Administrative Procedures 2002. Please find attached our response to submissions as a consolidated report.

If any additional information is required please do not hesitate to contact the undersigned.

Yours faithfully  
**WORSLEY ALUMINA PTY LTD**



Tim Eckersley  
Environmental Consultant

cc Mr Kim Taylor, EPA Service Unit.



**Worsley Alumina** Pty.Ltd.



**Worsley Alumina Project  
Efficiency & Growth  
Expansion to 4.4 Mtpa**

**Response to Submissions**

FINAL

September 2005



**Worsley Alumina Project  
Efficiency & Growth  
Expansion to 4.4 Mtpa**

Response to Submissions

FINAL

Prepared by Strategen for Worsley Alumina Pty Ltd

September 2005

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary Draft Report	V0a	TE/AF/EP	TE		29/8/05
Final Report	Final	TE/AF/EP	TE		1/9/05

## TABLE OF CONTENTS

<b>1.</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	PROPOSAL	1
1.2	ASSESSMENT PROCESS	1
<b>2.</b>	<b>DOCUMENT STRUCTURE</b>	<b>3</b>
<b>3.</b>	<b>KEY ISSUES RAISED</b>	<b>3</b>
3.1	BIODIVERSITY	4
3.1.1	Adequacy of data	4
3.1.2	Increased risk to flora and fauna species of conservation significance	7
3.1.3	Mechanisms for investigating and reviewing impacts prior to expansion into new mining areas	8
3.2	PROJECT TIMING	9
3.3	COMMUNITY STAKEHOLDER CONSULTATION	10
<b>4.</b>	<b>SUBMISSIONS FROM GOVERNMENT AGENCIES AND STATUTORY AUTHORITIES</b>	<b>12</b>
4.1	GENERAL	12
4.1.1	General issues	12
4.1.2	Stakeholder consultation	12
4.1.3	Adequacy of data analysis and write-up	13
4.2	ENVIRONMENTAL FACTORS ADDRESSED IN ERMP	13
4.2.1	Flora and vegetation	13
4.2.2	Fauna	17
4.2.3	Biodiversity	20
4.2.4	Salinity	21
4.2.5	Water resources	22
4.2.6	Air emissions	29
4.2.7	Noise	42

4.2.8	Aboriginal heritage and culture	45
4.2.9	Traffic (road and rail)	45
4.2.10	Bauxite transport	46
4.2.11	Risk assessment	47
4.2.12	Emergency preparedness and response	48
4.2.13	Closure planning	49
4.2.14	Rehabilitation	50
4.2.15	Health issues	53
4.2.16	Radiation	53
4.2.17	Impact on organic farming	54
4.2.18	Impacts on landowners	55
4.2.19	Other environmental issues	55
4.3	OTHER ISSUES	56
4.3.1	General issues	56
4.3.2	Approval process	57
<b>5.</b>	<b>SUBMISSIONS FROM NON-GOVERNMENTAL ORGANISATIONS</b>	<b>58</b>
5.1	GENERAL	58
5.1.1	General comments	58
5.1.2	Objection to the proposal	58
5.1.3	Stakeholder consultation	59
5.2	ENVIRONMENTAL FACTORS ADDRESSED IN ERMP	60
5.2.1	Flora and vegetation	60
5.2.2	Biodiversity	60
5.2.3	Salinity	61
5.2.4	Water resources	61
5.2.5	Air emissions	62
5.2.6	Noise	62
5.2.7	Bauxite residue	62
5.2.8	Greenhouse gas emissions	63
5.2.9	Recreation	63



5.2.10	European heritage and culture	64
5.2.11	Spread of disease	65
<b>6.</b>	<b>INDIVIDUAL PUBLIC SUBMISSIONS</b>	<b>66</b>
6.1	GENERAL	66
6.1.1	Stakeholder consultation	66
6.2	ENVIRONMENTAL FACTORS ADDRESSED IN ERMP	68
6.2.1	Flora and vegetation	68
6.2.2	Fauna	70
6.2.3	Landforms and soils	75
6.2.4	Salinity	76
6.2.5	Water resources	76
6.2.6	Air emissions	77
6.2.7	Noise	78
6.2.8	Recreation	79
6.2.9	Visual amenity	85
6.2.10	Traffic (road and rail)	85
6.2.11	Rehabilitation	86
6.2.12	Use of resources	88
6.2.13	Impact on organic farming	89
<b>7.</b>	<b>REFERENCES</b>	<b>90</b>
<b>8.</b>	<b>ABBREVIATIONS</b>	<b>92</b>

## LIST OF FIGURES

1.	Approvals process under State and Commonwealth procedures	2
2.	Indicative approach to undertaking future investigations	6
3.	Indicative mining schedule (Saddleback, Marradong and Hotham North mining envelopes occur in the existing approved Primary Bauxite Area)	10



## **1. INTRODUCTION**

### **1.1 PROPOSAL**

Worsley Alumina Pty Ltd (Worsley) proposes to expand its Bauxite-Alumina Project, which is located in the south west of Western Australia, by increasing alumina production from 3.7 to 4.4 Mtpa. This increase will require:

- an extension of mining operations into new areas and an increase in the rate of mining;
- additional bauxite transport corridors from the new areas to the existing overland conveyor;
- increased transport of raw bauxite on the existing overland conveyor; and
- refinery modifications and upgrades.

The proposed expansion is termed the Efficiency & Growth Project.

### **1.2 ASSESSMENT PROCESS**

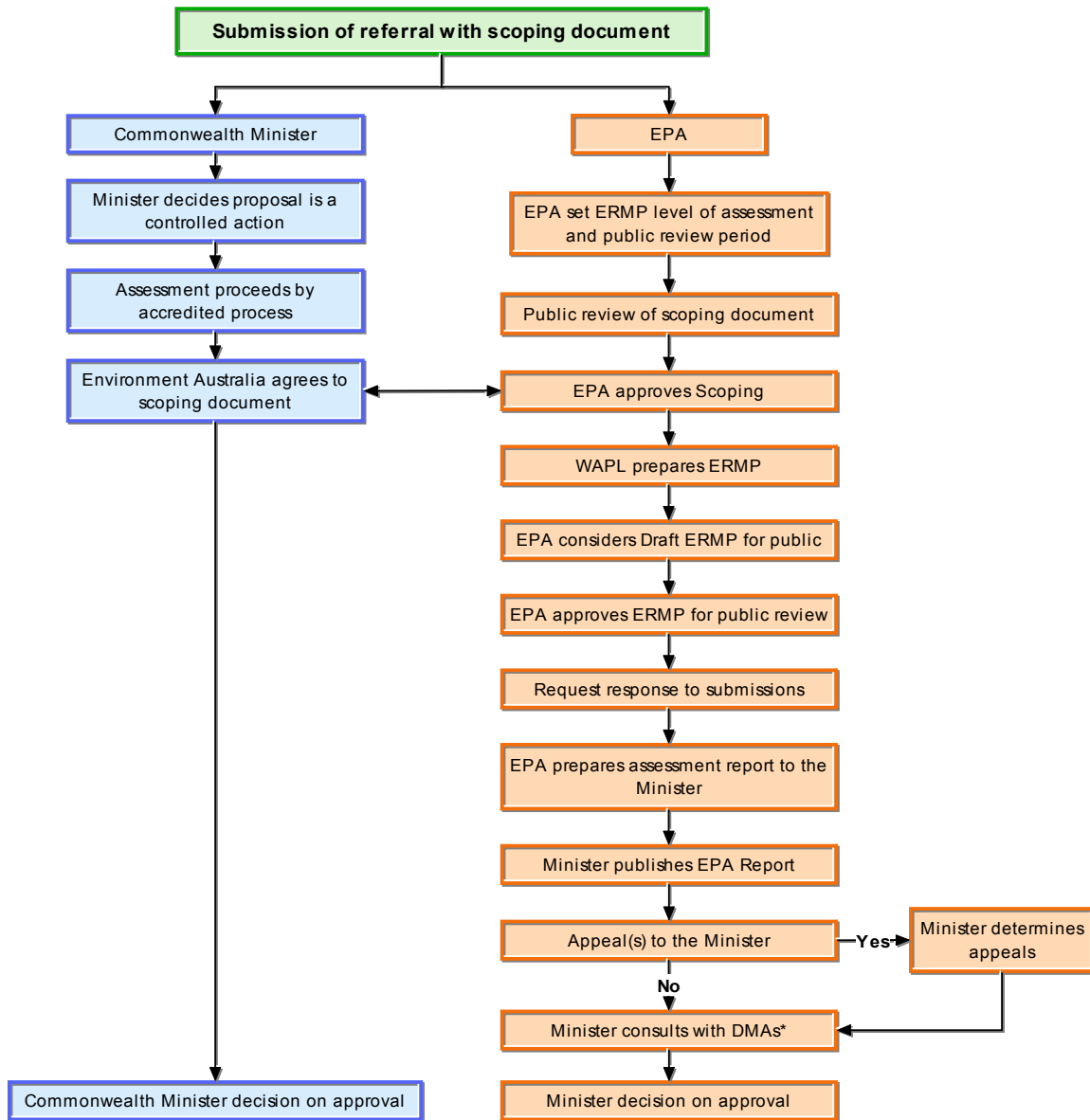
Worsley referred the Efficiency & Growth Project proposal to the Environmental Protection Authority (EPA) in June 2004 as required under Part IV of the *Environmental Protection Act 1986*. The proposal was assessed by the EPA as requiring formal assessment at the level of an Environmental Review and Management Programme (ERMP).

The proposal was determined to be a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) for listed threatened species and communities and for listed migratory species. In preparing the ERMP, care was taken to specifically address the potential impacts on those species listed under the EPBC Act.

The ERMP describes the proposal and examines the likely environmental impacts and the proposed environmental management procedures. It includes information from a number of environmental investigations, reviews environmental impacts and describes management measures that include avoidance, minimisation and offsetting to mitigate impacts that the proposal may have on the environment. In addition to extensive consultation with government agencies, non-government organisations and the wider community, the ERMP was released for a 10 week public review period from 26 May to August 1<sup>st</sup> 2005.

A total of 24 submissions were received from members of the public, non-government organisations, local government and government agencies. This document has been prepared on behalf of Worsley, to respond to the submissions received. This report will be considered by the EPA during its assessment of the proposal and in setting conditions pertaining to the proposal.

The environmental impact assessment and approval processes under State and Commonwealth environmental legislation are shown in Figure 1.1.



\*Decision making authorities

Figure 1.1 Approvals process under State and Commonwealth procedures

## **2. DOCUMENT STRUCTURE**

This document contains a summary of submissions received during the public review period of the ERMP and Worsley's response to the issues raised.

Submissions were grouped into three sections, and the full list of submission issues and responses is set out in Sections 4, 5 and 6, according to the following groupings:

- Section 4 – contains a collation of the issues raised in submissions from Government Departments and Statutory Authorities (13 submissions received). Each comment or issue responded to is attributed to the body that submitted it, where the identity is known.
- Section 5 – contains a collation of the issues raised in submissions from non-governmental organisations, i.e. community and environmental groups (4 submission received). Each comment or issue is attributed to the organisation that submitted it.
- Section 6 – contains a collation of the issues raised by individual members of the public (7 submissions received). A number of the submissions received were anonymous, as is allowed by the public review process. Where this is the case an assumption has been made that the submission was made by an individual member of the public.

Within each section, specific issues raised by the submission were grouped according to the general subject they addressed (eg. flora, fauna, air emissions), and a response has been prepared for each issue. Where the same issue is repeated, a cross reference is made to direct the reader to a common response.

## **3. KEY ISSUES RAISED**

Several issues were commonly raised in submissions. These include;

- biodiversity, in particular the adequacy of baseline flora and fauna data and the significance of impact on species of conservation significance;
- mechanisms for investigating and reviewing impacts prior to expansion into new mining areas;
- water resource protection and use;
- air emissions, in particular prediction of odour and BRDA particulates;
- noise from rail, road and bauxite transportation; and
- stakeholder consultation.

The majority of submissions have been addressed directly in sections 4, 5 and 6. However some aspects of those relating to adequacy of flora and fauna data, impact on biodiversity and the mechanisms for further investigations and review were judged to be the key issues raised and have been further addressed in this section.

Comments made in some submissions indicate that timing of the proposed mining may not have been adequately explained in the ERMP. Therefore this section also sets out the current mining schedule for the existing, approved and proposed mining to clarify the timelines for Worsley's operations in these areas.

### 3.1 BIODIVERSITY

A number of submissions regarding aspects of biodiversity were received. The key issues which were raised are as follows;

- inadequate flora and fauna data were presented in the ERMP to assess the long term impacts of proposed mining and bauxite transportation;
- the proposed expansion poses increased risk to flora and fauna species of conservation significance
- mechanisms can be developed for investigating and reviewing impacts prior to expansion into new mining areas.

Submissions on these issues were received from;

- Department of Conservation and Land Management (CALM)
- Western Australian Museum (WAM)
- Conservation Commission of Western Australia
- Conservation Council of Western Australia
- members of the public.

#### 3.1.1 Adequacy of data

A few submitters expressed the view that inadequate flora and fauna data were presented in the ERMP to allow assessment of the long term impacts of proposed mining and bauxite transportation. A number of the comments were specific to data collection, analysis and interpretation and adherence to the following publications;

- EPA (2002) *Terrestrial Biological Surveys as an element of Biodiversity Protection: Position Paper No. 3*
- EPA (2004) *Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56*
- Strategen (2004) *Worsley Bauxite Alumina Operation, Efficiency and Growth Increase to 4.4 Mtpa Alumina Production - Scoping Document*

Comments which were very specific are addressed in sections 4, 5, and 6. However the following general response is also provided.

The company began baseline flora and fauna investigations in the Boddington region in the 1970s and the proponent has conducted detailed flora and fauna surveys in its approved future mining areas (currently Marradong and Hotham North) and continues to add to the knowledge its has of these areas. Collection of baseline flora and fauna data and establishment of permanent baseline plots to allow comparison of “undisturbed” forest and rehabilitation is an established part of Worsley’s operating practices.

Worsley has operated its mining, bauxite transportation and refining operations in the jarrah forest since 1984. The company has conducted extensive baseline investigations in the existing Primary Bauxite Area since initial studies began prior to mining in the 1970s and has continued annual

comparative surveys in the original baseline plots and in all its post-mining rehabilitation since that time.

Initial studies are supplemented by detailed biological investigations prior to mining in new areas within the Primary Bauxite Area. The results are used in the development of detailed mining and rehabilitation plans. Baseline studies have been published and all progress and results of supplementary investigations are reported in Worsley's Annual Environmental Reports.

In addition to baseline investigations Worsley undertakes numerous research projects in conjunction with research bodies such as Curtin University, the University of Western Australia, Murdoch University, Kings Park Botanic Gardens, specialist consultants and industry research bodies. Worsley's research program is focused primarily on improvement of rehabilitation performance however other areas of research include forest disease and hydrological balance studies.

During the proponent's presentation on flora, fauna and rehabilitation to CALM, Western Australian Museum, Environmental Protection Authority Services Unit (EPASU) and the Department of Environment (DoE) in July 2005, agencies acknowledged that given the extent of the vegetated area covered by the indicative mining envelopes (54,774 ha), it would take many years to gather sufficient flora and fauna baseline data to satisfy the requirements of the guidelines. Worsley concurs and suggests it would therefore have been impractical to provide all the required baseline data in the ERMP document. It was considered appropriate to conduct an assessment for the ERMP in a regional context based on available vegetation complex and association data. This was supplemented by the use of CALM's publicly available data on Threatened Ecological Communities, Declared Rare Flora and threatened flora.

The ERMP included the site vegetation type information which had been collected and mapped during the preliminary stages of the Worsley's long term vegetation mapping program for the northern mining areas, however clearly the information presented was limited by its availability, which is itself a result of the time-consuming nature of detailed field work.

As noted in table 4.2.1 of this document, statistical analyses were conducted by a competent botanist on the site type vegetation and species information which had been gathered from this preliminary survey work, however the results were inconclusive and therefore a decision was made not to include them in the ERMP. Worsley recognises that statistical analyses form an important step in the interpretation of data and they will continue to form part of the ongoing fauna and flora survey and interpretation program which is discussed below.

In its submission the Western Australian Museum acknowledged that the desktop review of vertebrate fauna and some invertebrates in the ERMP was comprehensive, but noted that there is limited published data on many invertebrates and that the role that they play is under-recognised. Worsley concurs and acknowledges that further extensive field work is required at varying times of the year and over a number of years to gather a good baseline of data.

In the ERMP Worsley stated its commitment to continuing detailed baseline investigations and pre-mining surveys for all areas which will be disturbed by mining operations. This will complement desktop research and preliminary field surveys which were undertaken for the preparation of the ERMP. These investigations apply to numerous relevant environmental factors such as:

- flora and vegetation;
- fauna;

- water resources; and
- European and Aboriginal heritage.

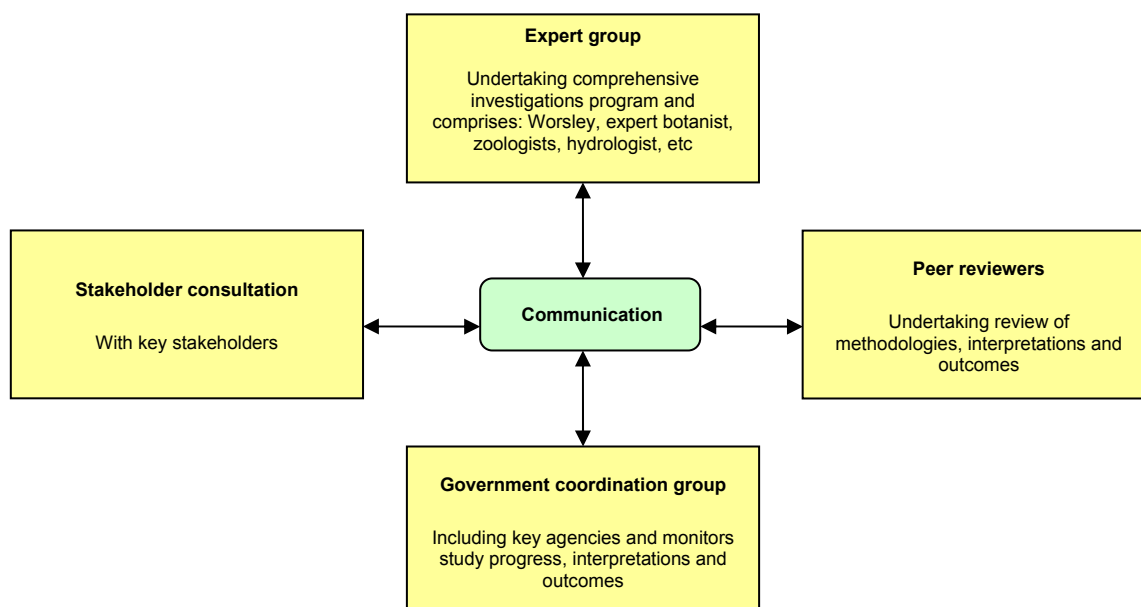
Investigations will be supplemented by Worsley's ongoing research programs and the results will be integral to the development of definitive mine plans.

The long term nature of the mine planning process (Section 3.2) and the availability of approved mining areas beyond the current Boddington Bauxite Mine at Mt Saddleback, mean that it is approximately 16 years before mining is due to commence in the first of the three northern mining envelopes. As demonstrated in the ERMP, with the presentation of preliminary site type vegetation data and fauna survey data for the Brookton and Central mining envelopes, Worsley has already commenced its survey program and it will continue for a number of years.

### **Approach to further work**

Worsley has acknowledged that the proposed new mining envelopes and adjoining areas may contain significant biodiversity values and that longer term investigations are required for some environmental factors to identify such values and to allow the refinement of appropriate mitigation measures to minimise any adverse impacts.

Worsley also acknowledges the potential complexity of completing the necessary investigations and that considerable resourcing, planning and coordination of such investigations is required. A possible approach to undertaking the relevant investigations may be modelled on the successful program by which Worsley initiated its Air Emissions Impact Assessment program as outlined in the ERMP (Volume 1, Chapter 5, Section 2.4). This involves the establishment of an expert panel to undertake investigations, a government coordination group, use of expert peer reviewers and consultation with key stakeholders. An indicative model of this approach is illustrated in Figure 3.1.



**Figure 3.1 Indicative approach to undertaking future investigations**



### 3.1.2 Increased risk to flora and fauna species of conservation significance

Several submissions identified that the proposed project will increase the risk posed to species of conservation significance. In the ERMP Worsley acknowledged the biodiversity values of the north eastern jarrah forest and the wider region, in particular those values which are associated with the transition of habitat from the jarrah forest of the Darling Plateau to the wheatbelt region.

The ERMP provides a description of vegetation associations and complexes that occur in the proposed new mining envelopes, and assesses the impact of proposed operations at a regional level (Volume 1, Chapter 3, Section 2). Three complexes in the proposed mining areas have less than 30% of their pre-European extent remaining – Lukin 2, Dalmore 2 and Michibin. Over 90% of proposed disturbance will occur on four dominant vegetation complexes, Coolakin, Yalabee 5, Yalanbee 6 and Dwellingup. All of these complexes have more than 30% of the pre-European extent remaining, and at least 30% of their current extant represented in reserves (Volume 1, Table 3.3 p3-19). Proposed mining activities will not take any vegetation complex below 30% of its pre-European extent.

As stated previously, the ERMP includes descriptions of site vegetation types mapped in the Central and Brookton mining areas and an assessment of their occurrence and significance (Volume 1, Chapter 3, Section 2). Of the 24 site vegetation types describes so far, all were observed to occur outside of the areas proposed to be disturbed by mining activities. Worsley is committed to undertaking detailed baseline surveys prior to mining that will ascertain the occurrence of site vegetation types throughout the proposed mining envelopes and transportation corridors.

The ERMP includes a description of fauna habitats and the occurrence, or likely occurrence of significant fauna species. Worsley presents a management approach to address loss of habitat and is committed to undertaking seasonal fauna surveys and avoidance of rare habitat. The avoidance of rare habitat is based on Worsley's existing regional knowledge that rare habitats may support unique fauna species. Examples given in the ERMP are granite outcrops and heathland that may support a high diversity of reptiles or bird species that are uncommon in the tall forest areas respectively.

#### **Avoidance criteria**

Within the ERMP Worsley has outlined an approach to managing biodiversity that either defers mining or excludes areas from mining. The decision to defer mining of an area is taken until such time as a high level of confidence is gained that environmental values can be restored. A decision to exclude an area from mining is taken for areas of high environmental significance or those areas protected by an established mechanism, e.g. under the *Wildlife Conservation Act 1950*.

In its existing operations in the Primary Bauxite Area, Worsley has typically deferred particular areas from disturbance from mining (e.g. an area known as the Tunnell Rd Heathland due to its considered environmental significance). Worsley has now proposed management actions within the ERMP that establish criteria for avoidance. Such management actions consider the following:

- threatened ecological communities (as listed by CALM or identified by detailed investigations covering the proposed new mining areas)
- substantial populations of Declared Rare Flora
- poorly represented vegetation communities
- heathland
- granite outcrop

- rare fauna habitat.

The establishment of avoidance criteria ensures favourable environmental outcomes. Avoidance criteria can be fully integrated with all planning of activities that result in vegetation disturbance.

### **Threatening processes**

The proposal involves the disturbance of approximately 8,400 ha over the projected 30 – 35 year life of the project (mining at an average of 240 ha/year). Around 40% of this disturbance will take place on privately owned land, with the remainder in State Forest.

The ERMP acknowledged the existence of threatening processes that may have impact on biodiversity such as land disturbance, spread of forest disease and salinity.

The bauxite mining process is conducted in “pockets”, whereby shallow mining is conducted in a few relatively small areas at a time. These are cleared, mined, reshaped and rehabilitated within a few years, rather than as a continuous open area. Mining in pockets allows retention of forested areas in between disturbed areas and also allows a high rate of direct return of topsoil, a technique which has been shown to result in an improved rehabilitation result. Worsley progressively rehabilitates all areas disturbed by mining operations.

The proponent employs a strict forest hygiene policy at all times throughout its mining, bauxite transportation and refining operations, in consultation with CALM. Through adherence to its forest disease management protocols Worsley has operated in the jarrah forest for over two decades and no spread of forest disease or increase in local or regional stream salinity has been observed in the current mining areas of its Primary Bauxite Area.

Worsley has made commitments in the ERMP to setup monitoring sites in catchments prior to mining and to continue to monitor them throughout the mining and post-mining phases. This will provide baseline salinity and water table data which will be used to develop mine plans and to manage the mining operations. Worsley has also initiated the formation of a salinity advisory group to provide guidance and peer review on future investigations and results. It is proposed that the group will comprise representation from the Department of Agriculture, CSIRO, CALM, DoE, Water Corporation and independent experts

### **3.1.3 Mechanisms for investigating and reviewing impacts prior to expansion into new mining areas**

In general, the submissions that raised concern over the adequacy of baseline data acknowledged that the opportunity exists for an alternative approach to a complete and definitive assessment of a 30 – 35 year project.

In its submission CALM has indicated support for a progressive approach to mining in new areas, based on an ongoing process of investigation and review in consultation with the relevant agencies. These investigations would provide adequate information for the development and clearance of more definitive mine plans. Discussions have been held between the proponent and relevant agencies regarding mechanisms that could be employed to facilitate such an approach whilst ensuring Worsley has access to resources over a sufficient timeframe.

Worsley has made commitments within the ERMP to undertake extensive investigations within proposed new mining envelopes prior to any disturbance of these areas. Worsley has also outlined an approach within the ERMP to undertake these investigations over a timeframe appropriate to developing an adequate understanding of potential impacts and to allow incorporation into the rolling Ten Year Mine planning process that is currently reviewed in consultation with the Environmental Management Liaison Group (EMLG) (e.g. Volume 1, Chapter 3, Section 4.4.3 outlines assessment of salinity hazard over a 10 – 15 year timeframe).

Worsley is in agreement with submissions suggesting an approach whereby the necessary investigations and detailed mine and bauxite transport route planning are undertaken within a system providing clearance of development proposals. Such a system could involve:

- setting conditions that establish outcome based criteria
- setting conditions that define the requirements and scope of investigations to be undertaken
- developing mechanisms for adequate consultation with key stakeholders in the undertaking of investigation and development of mine plans
- defining a mechanism for ensuring investigations meet scope requirements and for clearance of proposal for new mining areas.

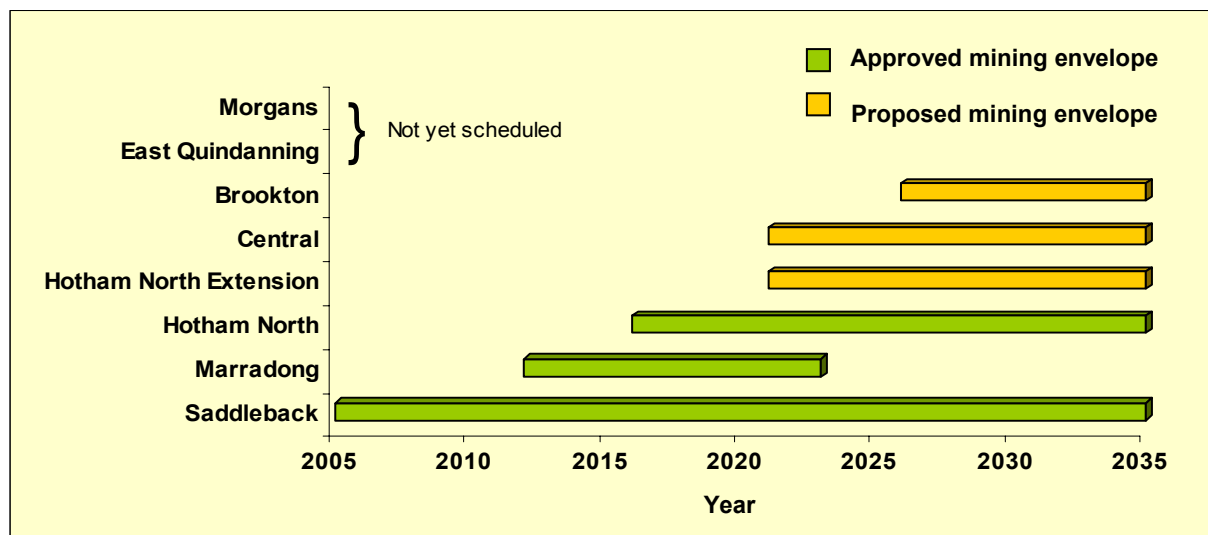
### **3.2 PROJECT TIMING**

As stated in the ERMP the proposed Efficiency & Growth Project has a nominal life of 30 – 35 years.

Existing mining operations are based on bauxite resources within the Primary Bauxite Area, and are located in the Saddleback, Marradong and Hotham North mining envelopes. Mining will extend into new mining envelopes over the projected life of the project, to ensure that the required tonnage of bauxite is delivered to the refinery. The indicative mining schedule to meet refinery requirements is shown in Figure 3.2. The schedule has been prepared based on existing known resource estimates and categories within proposed new mining envelopes. The mining schedule may alter following the completion of planned exploration drilling programs. Extension of transportation facilities will coincide with scheduled development of new mining envelopes.

Worsley acknowledges that extensive survey work and stakeholder consultation needs to be conducted prior to entry into the new mining areas. As indicated in Figure 3.2 expansion into new mining envelopes is not scheduled to occur for around 16 years. This is well beyond Worsley's current rolling ten year mine planning horizon, and provides Worsley with adequate time to undertake comprehensive investigations and stakeholder consultation.

The Efficiency & Growth Project represents a significant investment which is in the order of \$900 million. The Worsley Joint Venture Partners therefore require a high level of certainty regarding access to resources before making an investment decision. This could be achieved through approval of the expansion subject to a negotiated mechanism for investigation and review, in consultation with the relevant agencies (Section 3.1.3).



**Figure 3.2 Indicative mining schedule (Saddleback, Marradong and Hotham North mining envelopes occur in the existing approved Primary Bauxite Area)**

### 3.3 COMMUNITY STAKEHOLDER CONSULTATION

Several submissions from non-government organisations and individuals commented on the importance of ongoing stakeholder consultation, in particular, the need to identify and engage all relevant stakeholders in future consultation regarding mine planning in State Forest. Worsley recognises this need and provided detail of its current and ongoing stakeholder consultation plan in the ERMP (Volume 1, Chapter 2, Section 3). As bauxite mining operations are progressive, Worsley has an adaptive approach to ongoing stakeholder consultation. Additional detail relating to future stakeholder consultation processes is provided below.

Worsley's Ten Year Mine Plan, which is prepared annually and reviewed by the Environmental Management Liaison Group (membership and function described in Volume 1, Chapter 2, Section 3.2 of the ERMP), details mining operations for the ensuing ten years. When the ten year mine planning horizon extends into new areas, a process will be promptly initiated to undertake comprehensive consultation and relevant social and environmental investigations. The Ten Year Mine Plan process means there will be at least ten years between identification of new areas to be mined and mining commencing in a new area.

Independently chaired Community Liaison Committees (CLCs) have been established for the Worsley refinery and existing mine. The Community Liaison Committees hold regular meetings and are able to provide input in the environmental impact assessment and mine planning processes. When the Ten Year Mine Plan extends to new areas, Worsley will identify all relevant stakeholders and, if stakeholders are not adequately represented on the current mine Community Liaison Committee, will invite stakeholders to join or will establish a new Community Liaison Committee. This process will

ensure all stakeholder groups are able to provide input into the detailed assessment of social and environmental values, which will contribute to detailed mine planning.

Worsley will undertake a rigorous stakeholder identification process to ensure all stakeholders are informed and given opportunity to participate on Community Liaison Committees. Worsley also recognises stakeholder groups will have varying degrees of interest in bauxite mining operations in State Forest. Therefore, not all groups may wish to participate on the Community Liaison Committees but still may want to remain informed. Worsley will maintain communication with such stakeholder groups, and the general public, through Worsley's communication mechanisms that include:

- Worsley's website;
- one-on-one and group briefings and presentations;
- discussions and feedback;
- information sheets;
- newsletters and mail outs; and
- local media advertising features and releases.

## 4. SUBMISSIONS FROM GOVERNMENT AGENCIES AND STATUTORY AUTHORITIES

### 4.1 GENERAL

#### 4.1.1 General issues

Item	Submission	Response
1	Issues previously raised by Council with respect to the Worsley ERMP include:- <ul style="list-style-type: none"> <li>• General expansion logistics questions</li> </ul> (Shire of Harvey, received 3 August 2005)	This question does not raise specific issues to be addressed. As noted in Shire of Harvey submission, Worsley staff have briefed council on the proposed expansion and responded to general questions in areas of potential construction workforce camp, additional accommodation requirements and local infrastructure.
2	Overall, the ERMP and supporting documents are considered to represent a high quality of work. (Department of Health, received 9 August 2005)	No comments required.

#### 4.1.2 Stakeholder consultation

Item	Submission	Response
3	VOLUME 1, Chapter 2, Table 2.4, p2-17 of ERMP Regarding the first row - The Worsley CLC [Community Liaison Committee] was kept informed about progression of the ERMP and discussed/ had presentations on some parts of it, but the writer is not aware that it was given an opportunity to comment on the full Draft ERMP before this release. (Department of Environment South West Division, received 9 August 2005)	Noted. Comments from discussions with CLCs were incorporated in the final ERMP.
4	The Water Corporation was not listed as a participant in the Environmental Management Liaison Group (page 2-15, Volume 1). Given the Corporation's interest in the drinking water catchments that may be impacted, they should be represented in this group. In particular, advice should be sought from the Corporation in relation to Commitment 17 (Preparation of a Water Resource Management Plan). (Water Corporation, received 10 August 2005)	The Environmental Management Liaison Group (EMLG) membership has been established by the Minister for the Environment in Ministerial Statement 423. The Minister is able to change the membership of the EMLG if required. Worsley will consult with relevant stakeholders during the preparation of management plans.

### 4.1.3 Adequacy of data analysis and write-up

Item	Submission	Response
5	<p>There are some errors in the methodology and interpretation of environmental measurements, and inconsistencies within the Worsley Expansion ERMP that lead to a lack of certainty as to the conclusions drawn in respect of the proposal being able to meet appropriate environmental objectives.</p> <p>(CALM, received 3 August 2005)</p>	<p>Worsley has made commitments to continue detailed investigations. Such investigations will be carried out in a rigorous and structured program as outlined in response to key issues in section 3.</p>

## 4.2 ENVIRONMENTAL FACTORS ADDRESSED IN ERMP

### 4.2.1 Flora and vegetation

Item	Submission	Response
6	<p>The proposal will impact on flora species of conservation significance, will increase risk in the conservation of a number of vertebrates, particularly the black cockatoo species and has the potential to detrimentally impact on a number of short-range endemic invertebrates.</p> <p>(CALM, received 3 August 2005)</p>	<p>Refer to response to key issues above in section 3.</p>
7	<p>CALM currently receives compensation payments for this project in relation to lost forest values. These payments are required pursuant to the <i>Alumina Refinery (Worsley) Agreement Act 1973</i> and are calculated according to a formula relating to the loss of timber production capacity. With respect to any separate requirements for biodiversity conservation offsets, CALM would be pleased to work with the EPA to determine a suitable framework and regime for these.</p> <p>(CALM, received 3 August 2005)</p>	<p>The matter of biodiversity conservation offsets is the responsibility of the EPA.</p>
8	<p>The proposed extension of mining will mean that the overall extent of the proponent's active bauxite operations will increase from an area of the northern jarrah forest that is currently approximately 40 km from south to north and 10 km from west to east, to a final approximate size of 100 km by 30 km. The final size of the Worsley operations area will be much larger than the current operation and over its total lifespan is likely to have a significant effect on the values and management of lands managed by CALM within this area. The proposal area also lies at the eastern margin of the main belt of public forest estate and is in close proximity to important conservation reserves and public recreation assets.</p> <p>If approved, the proposal will result in the direct clearing of an area of approximately 20,235 ha of native vegetation, most of which the Department believes is good to excellent condition jarrah forest and wandoo woodland vegetation.</p> <p>(CALM, received 3 August 2005)</p>	<p>No response required. For clarification, the total estimated area to be cleared is ~8,400ha and not 20,235ha as stated.</p>

Item	Submission	Response
9	<p>CALM's view is that the flora and vegetation studies undertaken for the ERMP are not at the level appropriate for a single overall Government approval for mining and related activities within the areas described. While the studies provide useful information for consideration of impacts at a strategic level, their broad nature demands an approach to proposal implementation involving further detailed survey, investigation and impact assessment at the proposal element, or staged level, to ensure that the requirements of the EPA's Guidance Statement 51 are properly met.</p> <p>(CALM, received 3 August 2005)</p>	<p>Refer to response to key issues above in section 3.</p>
10	<p>The ERMP and Bennett Environmental Consulting (2004) provide a limited amount of information on the vegetation occurrence and flora in the Central and Northern mining envelopes. However, both documents have little or no ecological analysis of the data gathered, provide limited information on the impact of plant disease and provide an assessment of the quality of vegetation within mining envelopes that is at significant variance with CALM's understanding. The assessments of the impacts of previous disturbance, particularly fire, appear to be value judgements rather than scientific analyses.</p> <p>(CALM, received 3 August 2005)</p>	<p>Worsley has made commitments to continue detailed investigations. Such investigations will be carried out in a rigorous and structured program as outlined in response to key issues in section 3.</p>
11	<p>Bennett Environmental Consulting (2004) indicates that the methods used by Keighery in Wandoo woodlands to the east of the proposed were adopted for the current ERMP. The adoption of the 10 metre quadrat size may very well be appropriate. However, to justify the selection of quadrat size, the proponent should provide species accumulation curves, preferably from nested quadrats, to demonstrate that sampling effort per quadrat was sufficient. Why the species accumulation curves were not presented is unclear to CALM as they are not difficult to produce.</p> <p>(CALM, received 3 August 2005)</p>	<p>The focus of vegetation surveys has been toward obtaining an overview of the vegetation of the proposed new mining areas. Worsley has made commitments to continue detailed investigations. Such investigations will be carried out in a rigorous and structured program as outlined in response to key issues in section 3.</p>
12	<p>The ERMP does not contain any description of vegetation or flora data statistical analyses and the reader must assume that there are none.</p> <p>There are no descriptions of standard analyses or standard botanical indices, and not one reference to support the data analysis. The Department believes that this is a significant flaw in the ERMP.</p> <p>(CALM, received 3 August 2005)</p>	<p>Statistical assessment was undertaken on the site vegetation type and quadrat data separately in an attempt to determine any relationships within these assessments. Several different techniques were used including presence/absence; assigning a score of 1-5 for the percentage cover of each species; not including those species with a low cover. Each of the tables produced did not allow the ready separation of the groups. The statistical package used was Minitab and the analysis undertaken by a competent botanical consultant.</p>



Item	Submission	Response
13	<p>The Department believes that the descriptions of the vegetation condition provided in section 2.3.5 are not correct and may be misleading. It would appear that Bush Forever categories have been used to assess a large area of State forest. It is argued in the ERMP that because the area has been "heavily logged" (no logging data provided), Phytophthora cinnamomi dieback is present (disease front boundaries or assessments of impacts not provided), fire has impacted the area (no data on fire effects provided) and weeds occur in low densities, that forest and woodlands throughout the central and northern mining envelopes should be classified as Rating 3 – Good. This classification is below rating 2 – Excellent, and 1 – Pristine. The Department takes the view that the proponent should rectify this rating on the basis of the following:</p> <ol style="list-style-type: none"> <li>1. The proponent has made no justification for the use of the Bush Forever rating system in this forest.</li> <li>2. The proponent has provided no data to support any of the decision-making steps in rating the condition of the forest. Indeed, the ERMP indicates that in some instances full surveys were not undertaken; for example, dieback was simply "noted".</li> <li>3. As is the case with most of the botanical sections there are no analyses of data.</li> </ol> <p>The interpretation of fire data is not supported by scientific opinion on fire ecology in these environments. (CALM, received 3 August 2005)</p>	<p>Worsley acknowledges that the Bush Forever rating may be considered as subjective. The vegetation condition scale used in Bush Forever is that developed by B. Keighery (1994) for Bushland Plant Surveys and listed as one of the publications by the EPA when preparing terrestrial flora surveys. The rating presented in the ERMP has been made by an experienced botanist. Worsley will undertake a more detailed assessment of vegetation condition in consultation with CALM in subsequent investigations.</p>
14	<p>The ERMP has argued that frequent fires (without providing definition of the term 'frequent') have adversely affected the quality of forest and woodland in the central and northern mining envelopes. To support this statement the ERMP includes in Figure 3.7 burn boundaries and associated fuel ages. It provides no information (current or historic) or analysis on spatial or temporal heterogeneity for fire regime statistics such as the patchiness of burnt and unburnt areas, fire intensity, season of fire occurrence nor the scale of areas affected by fire. (CALM, received 3 August 2005)</p>	<p>CALM has been contacted, and detailed information on fire history is to be taken into account in further investigations.</p>
15	<p>Reference to declared rare flora and the comment regarding excluding any exclusion of 'substantial' populations (Executive Summary pg 14) requires better definition of 'substantial' and recognition that taking of any population of Declared Rare Flora will require Ministerial approval. Plans are required to address the avoidance and management of impacts to Declared Rare and Priority Flora. (CALM, received 3 August 2005)</p>	<p>The term "substantial" has been used in the commitment to differentiate single or isolated occurrences of Declared Rare Flora. Worsley acknowledges requirements for disturbing any Declared Rare Flora and will follow due process should any disturbance of Declared Rare Flora be required.</p>
16	<p>It is noted that the proponent plans to exclude mining from Dalmore 2 and Lukin 2 vegetation complexes "where not severely degraded" (Vol 1 pg 3.37). These complexes occur at less than 30% of pre-European extent. The Michibin complex should also be considered for total exclusion from mining as its extant occurrence is listed at 19.6% of pre-European extent of which only 36.6% is represented in reserves (Table 3.3 pg 3-19). (CALM, received 3 August 2005)</p>	<p>The Dalmore 2 and Lukin 2 vegetation complexes are known to occur on cleared agricultural land and are potentially subject to agricultural grazing for many years. The condition of these complexes will be assessed prior to finalising any decision on avoidance. Such decisions shall be made in consultation with the EMLG.</p> <p>Worsley acknowledges the status of the Michibin vegetation complex, which also occurs predominantly on private land, and will assess the extent, condition and occurrence of bauxite within this complex.</p>

Item	Submission	Response
17	<p>The ERMP proposes the exclusion of mining or clearing from specific habitats such as heaths and granite rock outcrops including adequate buffers (Commitment 5). Buffers should extend beyond the ecotones of these landscape features in order to protect their integrity. CALM considers that there is the potential for significant indirect impacts on some of these features as a result of the presence of the mine, for example fire would have to be totally excluded from heaths for an extended period until large scale burning was possible, as any small scale burning of heath pockets is likely to result in exacerbated grazing impacts that would not occur normally. Any potential implications of long term fire exclusion (ie senescence of the vegetation community) need to be understood and managed.</p> <p>(CALM, received 3 August 2005)</p>	<p>Worsley proposes to determine adequate buffer requirements during development of the Ten Year Mine plan in consultation with the EMLG.</p>
18	<p>The ERMP summarises an increase in the annual area of disturbance in the north eastern State Forest of the order of 70% (from 140ha pa to 240 ha pa) and an overall expansion of the mining envelope from some 400km<sup>2</sup> to 3000 km<sup>2</sup> over a 35 year period. The rate of change to the landscape and the overall changes envisaged are issues that need to be addressed in this area which is understood to support jarrah forest and wandoo woodland vegetation in excellent condition.</p> <p>The particular issues in relation to matters such as the progress in rehabilitation and the uncertainty about the detail of ecosystem values and the actual development program have been well addressed by the Department of Conservation and Land Management. It is agreed that a staged approach of the project is appropriate to address these matters.</p> <p>Action 5.1 of the Forest Management Plan 2004-2013 encourages mining companies to act in a manner consistent with the Plan. In this regard the ERMP describes at pages 2-8 and 3-59 that indicative fauna habitat zones have been defined in and adjacent to the proposed new mining envelopes with protection to be afforded following exploration and mining.</p> <p>A mid term audit of performance under the Forest Management Plan 2004-2013 is to be provided to the EPA by the end of 2008 with an end term audit in December 2012. Such a large area of forest is potentially to be affected by this proposal, and over such a long period, that consideration should be given to parallel reporting of the project's environmental performance at these times to provide a better understanding of the implications of commercial activities in the forest. It would be desirable for future Forest Management Plan to provide an opportunity to achieve more integrated sustainable forest management through more closely engaging the broad range of commercial activities within the forest. The aim of such an approach would be to achieve more efficient and effective management regimes.</p> <p>(Conservation Commission of Western Australia, received 19 August 2005)</p>	<p>Refer to response to key issues above in section 3.</p> <p>Worsley acknowledges requirements for the Conservation Commission to carry out a mid-term audit of the Forest Management Plan and will make reporting of the projects environmental performance available to the Commission. Reporting of performance is currently undertaken in consultation with the EMLG as required by Ministerial Statement 423.</p>

## 4.2.2 Fauna

Item	Submission	Response
19	<p>The documentation of faunal components and potential environmental impacts upon them is based on a desktop review of the literature for the study area, specifically the two northern envelopes encompassing State forest, a brief targeted field survey on Critical Weight Range [CWR] mammals and a targeted survey for black cockatoos, including nest hollows.</p> <p>The majority of the faunal comments pertain to the commitments of the proponent to Ministerial caveats and they all seem appropriate as outlined in commitments to Ministerial Statement No. 423, the Flora, Fauna and Forest Protection Plan, the Forest Disease Management Plan and the Rehabilitation Plan [pages 3-60, 3-61].</p> <p>The faunal desktop review is comprehensive and documents the vertebrate and some invertebrate species of likely 'Conservation Significance' [defined page 3-44] that could occur in the study area using both Museum databases and unpublished reports. However, there is little published literature on the invertebrates likely to occur in the extension area and, consequently, there is limited recognition of the diversity and the critical functional processes dependent on this faunal element. The taxonomic authority for amphibians, reptiles and mammals is cited as WA Museum (2001) but that for birds as Christidis and Boles (1994); no explanation is presented for this dichotomy of selected authorities. There is also a need to recognise that a significant faunal database exists that is associated with CALM's Western Shield program and the information contained in that database would add more clarity to species likely to occur in the forested areas.</p> <p>The survey focus on Critical Weight Range mammals as a target group for consideration is surprising given the recent debate casting doubt on the whether mammalian extinctions and conservation should be focussed on this group [Cardillo, M. and Bromham, L. Body size and risk of extinction in Australian mammals. Conservation Biology 2001, 15: 1435-1440]. The fact that only four nights sampling was assigned to this aspect further downplays the relevance of these elements to the overall conservation picture.</p> <p>(WA Museum, 29 July 2005)</p>	<p>The lack of available data on invertebrates has been identified as a deficiency in the undertaking of fauna investigations. An option for further studies is to target taxa known to include a high proportion of short range endemics (eg. mygalomorph spiders, centipedes, millipedes), with work focussing on rare habitats in the region (sandy soils, granite outcrops).</p> <p>In most cases where differences exist between Christidis and Boles (1994) and the WA Museum Checklist (WA Museum 2001), alternative names are given in parenthesis. In addition, however, it should be noted that Christidis and Boles (1994) is widely accepted as the international standard for Australian birds, whereas the WA Checklist contains a number of significant differences, including species in different genera and at least one full species, that are not recognised in other literature. This is not to say, however, that they may not be accepted in the future. An internationally peer-reviewed revision of Christidis and Boles is underway.</p> <p>CALM's Western Shield database. The existence of records from the project area in this database was not mentioned by CALM personnel. An approach to CALM will be made to see if any relevant data are available.</p> <p>Focus on Critical Weight Range Mammals. This was requested by DoE and CALM at an early meeting discussing the project. Sampling on this group was carried out at a poor time of the year because of the timing of the project, and further sampling, at a more appropriate time of the year, is planned. The reference cited in the WA Museum submission will be accessed.</p> <p>Refer to response to key issues above in section 3, in particular commitments to undertake further investigations.</p>
20	<p>Targeted surveys for black cockatoos were, likewise, unlikely to document significant information given the seasonal and durational limits of the sampling period. Much of the two northern mining envelopes contain breeding sites for Carnaby's Cockatoo and only limited field investigation has been undertaken by fully qualified Museum experts in this region. All the proposed mining envelopes contain important, and in some cases 'critical', habitat for threatened cockatoos. Habitat loss through bauxite mining is listed as a major 'threatening process' for both Baudin's and the Forest Red-tailed Black Cockatoo in the draft Recovery Plan. Long-term surveys are essential to map existing habitat usage by threatened cockatoos and provide information critical to minimising the effects of mining on habitat loss.</p> <p>The commitment of Worsley to conditions prescribed in the Ministerial Statement No. 423 should ensure that adequate information is available, on an ongoing, basis to assess the impacts of the proposed extension on faunal populations and environments.</p> <p>(WA Museum, 29 July 2005)</p>	<p>The significance of the area for these three taxa is recognised and intensive work on them is planned for the coming years. WA Museum staff experienced in studying these species have been approached regarding the possibility of collaborative investigations in this area.</p>

Item	Submission	Response
21	<p>It is essential that faunal surveys are undertaken prior to mining and are temporally spaced to account for seasonal variation, but these surveys should also target specific invertebrate groups and short-range endemic fauna. It is commendable [page 3-56] that the company's current fauna and flora conservation strategy has been developed in consultation with CALM, the major public landholder with responsibility for conservation and management of biological resources. It is remarkable, however, that despite the Worsley's annual compensation payment to the State, amounting to approximately \$1.5 million dollars in 2004, that the State [Executive Summary page 14-15] has never undertaken a major biological survey of the Jarrah Forest bioregion. It is apparent that there is a need for an independent assessment of the biodiversity of these unique ecosystems and this should be undertaken in conjunction with the planned monitoring of flora and fauna abundance in forests adjacent to mined areas.</p> <p>The 'retention of the significant majority of fauna habitats within the five mining envelopes' is predicated on defining what constitutes a 'significant' majority in terms of area. For the highly mobile and threatened black cockatoos it may necessitate the retention of upwards of 90% of habitat to ensure adequate protection of food resources on an appropriate spatial scale as well as sufficient mature trees for these obligate hollow-nesting species.</p> <p>(WA Museum, 29 July 2005)</p>	<p>Comments are of a general nature and re-affirm Worsley's commitment to undertake intensive fauna studies over a long time period in the area. These studies should develop an understanding of the fauna of the area and their relationships with the environment. Given the size of the area and nature of the proposal, such understanding is essential in order to understand and minimise impacts, and to guide rehabilitation.</p>
22	<p>The recognition [page 3-56] of the need to minimise mining operation areas, control feral animal populations and provide habitat for linkages for fauna and flora movement are significant and show understanding of the likely long-term changes that follow major anthropogenic changes to the environment.</p> <p>(WA Museum, 29 July 2005)</p>	<p>No comment required.</p>
23	<p>The proposal will impact on flora species of conservation significance, will increase risk in the conservation of a number of vertebrates, particularly the black cockatoo species and has the potential to detrimentally impact on a number of short-range endemic invertebrates.</p> <p>(CALM, received 3 August 2005)</p>	<p>Refer to response to key issues above in section 3.</p>
24	<p>A fundamental requirement of an ERMP may be regarded as the provision of adequate information to enable the prediction of impacts with an appropriate degree of certainty to allow:</p> <ol style="list-style-type: none"> <li>1. the consideration of the acceptability of impacts; and</li> <li>2. the identification of appropriate management measures to satisfactorily manage and mitigate those impacts.</li> </ol> <p>An alternative approach that may be considered appropriate in some cases can involve the identification of key risks at the 'strategic' or 'in-principle' project approval stage and the incorporation, within the proposal, of a technically robust, legally binding, and publicly transparent mechanism for progressive investigation, assessment, adaptation and approval of successive development stages.</p> <p>(CALM, received 3 August 2005)</p>	<p>The comments from CALM clearly identify concern with the scale of the proposed development and the submission of the ERMP when only some fauna studies had been undertaken. In the covering letter by the Executive Director, there is brief discussion of an "alternative approach" to the ERMP, in which Worsley would be committed to "progressive investigation, assessment, adaptation and approval of successive development stages". This would be an alternative to approval based upon an ERMP that assesses impacts and identifies management strategies to ameliorate impacts, which Worsley supports.</p> <p>Refer to response to key issues above in section 3.</p>

Item	Submission	Response
25	<p>CALM's view is that the fauna studies undertaken for the ERMP are not at the level appropriate for a single overall Government approval for mining and related activities within the areas described. While the studies provide useful information for consideration of impacts at a strategic level, their broad nature demands an approach to proposal implementation involving further survey, investigation and impact assessment as part of a staged assessment and approval approach to ensure that the requirements of the EPA's Guidance Statement 56 are properly met.</p> <p>(CALM, received 3 August 2005)</p>	Refer to item 24 above.
26	<p>The review and assessment of fauna within the Worsley Expansion Project is limited to a desktop review of the literature, three trap lines sampled in September 2004 for Critical Weight Range mammals, and limited searches for potential forest black cockatoo nesting trees. The review of databases on the potential occurrence of fauna is thorough. However, on the basis of the limited scale of investigations outlined in Bamford et al. (2004), the Department cannot assess the environmental impact on fauna from the proposal. Indeed, preliminary species accumulation data seem to suggest that the area has the potential to be unusually species rich in vertebrates. Bamford et al. (2004) support the hypothesis that the area covered by the Central and Northern envelopes is representative of an ecotone. Given that other jarrah-wandoo ecotones in Western Australia are of extremely high conservation significance (eg. Perup, Julimar), and given the paucity of fauna data in the ERMP, it would be prudent to assume that the current proposal also includes areas of very high conservation significance. The Department is of the opinion that the limited information on species accumulation provided in the ERMP suggests that the Central and Northern envelopes may indeed be of special conservation significance.</p> <p>(CALM, received 3 August 2005)</p>	Refer to item 24 above.
27	<p>The ERMP indicates that the proposal, through clearing of vegetation, can potentially affect a number of arboreal vertebrate fauna. However, the ERMP and Bamford et al. (2004) have not provided an analysis of the level of increased risk to the conservation of fauna, particularly for the cockatoos.</p> <p>The Department believes that Black cockatoos (Carnaby's, Baudin's and Forest Red-tailed) are a group of species that are vulnerable to significant impact from the proposal, and that the level of risk to cockatoos should be specifically identified and managed.</p> <p>(CALM, received 3 August 2005)</p>	Refer to item 24 above.
28	<p>The ERMP includes a commitment to "identify rare habitats....." (Vol 1 pg 3-60). This needs to be detailed more fully.</p> <p>(CALM, received 3 August 2005)</p>	Refer to response to key issues above in section 3.
29	<p>Feral animals should be controlled throughout Worsley controlled land.</p> <p>(Water Corporation, received 10 August 2005)</p>	Worsley has had in place a feral animal control program, and has committed to continuing with this program for expanded operations (Volume 1, Chapter 3, Section 3.6).

### 4.2.3 Biodiversity

Item	Submission	Response
30	<p>There is insufficient information available within the ERMP documentation to be able to predict impacts in relation to biodiversity values at this point in time with any acceptable degree of certainty, and certainly not 20 to 30 years into the future.</p> <p>(CALM, received 3 August 2005)</p>	Refer to response to key issues above in section 3.
31	<p>On the basis of the potential impacts of the proposed expansion occurring over such a large area of the Darling Range and inadequate information provided in the ERMP, the Department believes that the proposal potentially presents significant risks to the conservation of biodiversity and other values of the region. In CALM's view the ERMP has not demonstrated, with sufficient certainty, that the elements of the proposal that impact on these values can be adequately designed and managed so as to be made environmentally acceptable. It is therefore CALM's view that it is not possible to undertake an adequate assessment of this entire project based on the information contained within the ERMP.</p> <p>(CALM, received 3 August 2005)</p>	Refer to response to key issues above in section 3.
32	<p>Commitment 5. Vegetation, flora, fauna and rehabilitation</p> <ul style="list-style-type: none"> <li>• Mining within the individual 'new mining areas' should not commence until the Flora, Fauna and Forest Protection Plan has received specific approval for any 'new mining area'.</li> <li>• The Flora, Fauna and Forest Protection Plan should provide for adequate impact prediction and identify management measures for species and communities of conservation significance subject to the approval of the Minister for the Environment on the advice of CALM and DoE. The plan should address the avoidance and management of impacts to Declared Rare and Priority Flora, and should plan to avoid any impacts on the Michibin vegetation complex and to avoid loss of significant ecological linkages. The plan should be subject to appropriate review and improvement processes.</li> <li>• The development and update process for the Flora, Fauna and Forest Protection Plan should include opportunity for public review subject to the approval of the Minister for the Environment on the advice of DoE and CALM.</li> <li>• The scope and timing of further biological surveys should be subject to the approval of the Minister for the Environment on the advice of CALM and DoE.</li> <li>• The Flora, Fauna and Forest Protection Plan should identify opportunities for programs to mitigate the risk of impacts on fauna of conservation significance in advance of impacts. This should include and expand on the proponent's existing support for the Western Shield program and other programs as required. Other programs could include funds for research and for recovery plans for species identified to be at risk as a result of further studies. Feral animal control should continue through the life of the mining project in order to mitigate impacts on native fauna.</li> </ul> <p>(CALM, received 3 August 2005)</p>	Matter to be addressed by the EPA.

#### 4.2.4 Salinity

Item	Submission	Response
33	<p>Prior to the proposal being implemented, there needs to be a clear demonstration, based on field measurement and modelling, that there will be no significant impact on stream flow and salinity from mining and rehabilitation activities and other contaminants.</p> <p>Modelling is required in relation to impacts on stream flow and salinity by mining operation and rehabilitation using a hydrological model approved by the Department of Environment (DoE) prior to work commencing. Outcomes from this modelling can then be used to determine the water impacts and under what conditions mining can proceed, if at all.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Worsley has committed to intensifying its water resources investigations and incorporating these investigations in a 10-15 year mine planning horizon.</p> <p>A paired catchment study has been running since the mid 1970s prior to mining commencing. These investigations have recently been written up on behalf of the DoE and include analysis of modelling using the Water and Rivers Commission's WECc model. In addition, Worsley has commenced the development of a predictive tool to assess water resources response to mining. Validation of this model is being undertaken with the development of new groundwater monitoring wells. The predictive tool identifies areas at risk, in particular to groundwater rise, and is being used in the development of mining plans.</p>
34	<p>Alcoa are not allowed to mine in the lower rainfall areas of Perth's drinking water catchment until they demonstrate they will not have a significant impact on the salinity of the water resources, and have been researching the impact of mining in the lower rainfall areas of the region for approximately two decades. Whilst Worsley should not be required to spend two decades of research before they can start mining, this precedent needs to be considered when assessing Worsley's proposal.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Alcoa's operations to date occur in distinctly different geographical areas to Worsley's and have on occasion been located in close proximity to drinking water supply dams. In contrast, Worsley's operations have so far not occurred in any public drinking water supply areas. Alcoa is also undertaking an extensive investigations program to assess the risk of salinity occurring in the intermediate rainfall zone of the Darling Plateau. It has traditionally been recognised that the risk of salinity occurring in the low rainfall zone where Worsley's mining operations occur is lower due to the greater depth to water table in this area region. No impact on regional salinity has been observed due to Worsley's mining operations. Nevertheless the potential for Worsley's operations to impact on water resources is recognised as a significant environmental factor. Worsley has committed in the ERMP to implementing an investigations and monitoring program that will be undertaken over a long timeframe and integrated with the preparation of the rolling Ten Year Mine Plan.</p> <p>Worsley agrees that water supply, in particular in the future and in public water supply catchment areas, is a significant issue to take into account in the management of water resources. Worsley commits to addressing such issues in the development and implementation of its water resources management plans.</p>

#### 4.2.5 Water resources

Item	Submission	Response
35	<p>Issues previously raised by Council with respect to the Worsley ERMP include:-</p> <ul style="list-style-type: none"> <li>Ensuring sufficient environmental and aesthetic flows are available for the Brunswick River and its tributaries.</li> </ul> <p>(Shire of Harvey, received 3 August 2005)</p>	<p>Worsley is currently licensed under the <i>Rights in Water and Irrigation Act 1914</i> to abstract 2.1 GL/a from the Augustus River, a tributary of the Brunswick River. The Augustus River catchment is estimated to represent around 5% of the total flow in the Brunswick River. The licence requires that a basal flow of 35 m<sup>3</sup>/hr be maintained over the summer months. This summer flow requirement was established to provide a basal summer flow to the downstream Beela Dam, that previously provided drinking water supplies to Brunswick and Roelands (both of these communities are now connected to the States Integrated Water Supply System).</p> <p>Worsley has recently made application to the DoE as part of licence renewal requirements to increase its water entitlement by 0.5 GL/a to 2.6 GL/a. This application includes the establishment of the ecological water requirement (EWR) of the Augustus River and proposes to remove the existing requirements to release water during the summer months and establish release requirements to reflect natural seasonal variation in stream flow. The EWR has been estimated by independent consultants, Wetland Research and Management, and is to be assessed by the DoE in conjunction with the application to amend the licence.</p>
36	<p>It is noted that the proponent is seeking sources of refinery water for an extra 2GL per annum (Vol 1 pg 1-41). Coal field mine dewatering is noted as a potential source. Consequently the refinery may be competing with the future power stations for a water resource. Our understanding is that potable water is not essential, however, water less than 1500ppm of salt is. Alternatives which should be considered include promoting waste water recycling by re-using the chlorinated 1.72 ML daily average discharge from the Collie Waste Water Treatment Plant, Wellington Dam and desalination of the power station saline discharge pipeline water. In the past the refinery has sourced potable drinking quality water from the Harris Dam during supply shortages. The use of good quality drinking water for industrial purposes increases the demand for development of harnessed catchments in natural areas for drinking water purposes and should be discouraged.</p> <p>Recommendation</p> <p>The proponent be required to examine all viable options for refinery water supplies to the requirements of the Minister for the Environment.</p> <p>(CALM, received 3 August 2005)</p>	<p>Matter in part (recommendation) to be addressed by the EPA.</p> <p>As described in the ERMP, Worsley is investigating several potential water sources (Volume 1, Chapter 1, Section 4.3.6). It should be noted that the refinery requires water of potable quality. Also as explained in the ERMP (in above mentioned section) additional water is not required for the expansion under average rainfall conditions. See also response to item 39 below.</p>
37	<p>Commitment 8. Water Resources</p> <p>Mining within harnessed water catchments should be deferred until rehabilitation is considered sustainable and there is a high degree of certainty in regard to predicting potential for salinity to impact the catchments as a result of rising groundwater.</p> <p>(CALM, received 3 August 2005)</p>	<p>See response to items 33 and 34.</p>
38	<p>VOLUME 1, Chapter 1, Section 4.3.6 of ERMP</p> <p>The common short form of the Rights in Water Irrigation Act 1914 is the RIWI Act or RIWI Act 1914.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted.</p>



Item	Submission	Response
39	<p>VOLUME 1, Chapter 1, Section 4.3.6 of ERMP</p> <p>The Worsley water efficiency programme is critical and to be applauded. Nonetheless, their water needs and the source of these needs is somewhat unclear. Firstly, the need for a supplementary water supply for the expansion is still not known, making any further comments on supply highly qualified. It is stated that a detailed water management plan is being developed. DoE has not seen a draft of this plan to date. It also states that 'demand for fresh water may increase by up to 2GL if lower than average rainfall persists, even for existing refinery operations'. A water management plan will need to detail where this additional water will be sourced.</p> <p>Secondly, if extra resource is required, then the alternatives being investigated should be more clearly defined in the ERMP. The four dot points at the top of p 1-41 need clarification. Is dot point one referring to extraction from the Harris/Stirling Dam systems?</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>The refinery water balance is a complex system and extremely variable in respect of management of freshwater and contaminated water storage facilities even under normal seasonal conditions. At expanded production, and under average rainfall conditions the refinery will continue to use the same volume of fresh water as for current operation (ie ~1.9 ± 0.2 GL/a). As is indicated in the ERMP (Volume 1, Chapter 1, Section 4.3.6) Worsley is preparing a detailed water management plan that is aimed at managing the variability in the site water balance. Any components of this plan that involve requirements for additional water supply will be developed in full consultation with the DoE.</p> <p>The dot pots presented refer to potential water sources that can be investigated by Worsley. Connection with the States Integrated Water Supply Scheme (dot point one) would involve a supply contract with a water service provider. The source of that water is under the control of the service provider.</p>
40	<p>VOLUME 1, Chapter 1, Section 4.3.6 of ERMP</p> <p>Regarding dot point two- The RIWI Act application has been received and is being assessed by the Department. The environmental water requirements (EWR) report, relative to potential impacts on the Augustas River, did not however accompany it. Without the EWR report, assessment of the requested increased entitlement cannot be progressed.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>The application to increase the allocation from the Augustus River is being processed under the RIWI Act and is not part of the efficiency &amp; growth proposal or included in the ERMP. The EWR report will be provided to the DoE when finalised.</p>
41	<p>Relative to point 3- What does "local and regional supplies" mean? eg could that include a pipe head dam on the Augustus River, as previously muted?)</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>No specific local and regional water sources have been identified to date. Investigations can be considered as at a conceptual level only at this time.</p>
42	<p>Relative to point 4- It should be noted that any mine dewatering water is not a committed allocation and subject to availability.</p> <p>It would have been hoped that the investigation of refinery water supplies would have been progressed further, prior to submission of this ERMP.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>As indicated in item 39, no additional water requirements are specifically required for the proposed expansion. Therefore the aspect of water supply has not been treated in any detail in the ERMP.</p>
43	<p>VOLUME 1, Chapter 2, Table 2.4, p2-17 of ERMP</p> <p>Regarding fourth row - One of the issues raised by the LGAs was "consideration to environmental flows of tributaries within the impacts catchments", and relate to comments under section 4.3.6. The response column does not really appear to respond to this concern relative to the refinery. Ie "not included in scope of ERMP." The referenced Section 4.3.6 only deals with mining related water issues.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. See response to item 35.</p>
44	<p>VOLUME 1, Chapter 5, Section 4.2.2, P5-71 of ERMP</p> <p>EWP's [ecological water provisions] cannot be less than EWR's [ecological water requirements] as they are a component of EWP's.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted.</p>

Item	Submission	Response
45	<p>VOLUME 1, Chapter 5, Section 4.2.3, P5-71 of ERMP</p> <p>Lot 101 downstream of the FWL is owned by Worsley and has a priority 2 classification.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.
46	<p>VOLUME 1, Chapter 5, Section 4.2.4, P5-71 of ERMP</p> <p>Dot point 4 – Understood that ‘summer’ as determined by Worsley is from 1 December to 31 March each year. Needs agreed clarity.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.
47	<p>VOLUME 1, Chapter 5, Figure 5.21, p5-75 of ERMP</p> <p>Is a bit simplistic, in that the Freshwater Lake (FWL) surface water catchment commences at the FWL dam, and does not go above the northern and southern pipehead dams and the nearest process area boundary (i.e. is smaller than indicated)- unless this diagram is indicating an actual/potential groundwater catchment under the BRDAs. Any “freshwater” surface runoff from the process area and to its east would end in the “contaminated” Refinery Catchment lake (RCL), unless diverted, and should be depicted as “contained water”.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	The figure is indicating the separation of the freshwater and contained water catchments. Diversion drains do in fact exist to the east of the process area to divert freshwater around the process area and eventually to the freshwater lake.
48	<p>VOLUME 1, Chapter 5, Figure 5.23, P5-77 of ERMP</p> <p>Worsley is to be commended for the improvement in water use efficiency and reduction in use of fresh and recycled water. Figure 5.23 however indicates that fresh water use in 2000/01 and 2001/02 exceeded the licence entitlement from the FWL and would therefore constitute a breach of licence conditions. An explanation in this regard should be given.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	The freshwater usage above 2.1 GL indicated for the 2000/01 and 2001/02 periods spans a period when an additional gigalitre of freshwater was imported to the refinery following a period of very low rainfall. This import of water was by arrangement with the Water Corporation and has been documented in the relevant Annual Environmental Reports and is indicated in the ERMP (Volume 1, Chapter 1, Section 4.3.6).
49	<p>VOLUME 1, Chapter 5, Section 4.6, P5-78 of ERMP</p> <p>Dot point 2 – this commitment needs to be clearly defined. That is, what constitutes ‘periodic’ and specifically what does ‘ecological monitoring’ entail?</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Monitoring has been undertaken around every five years and includes monitoring of freshwater fauna species occurrence and abundance. Monitoring has also included evaluation of bioaccumulation of metals in filter feeder species. Results of these monitoring programs are included in the Annual Environmental Reports. The last ecological monitoring program was undertaken in 2001.
50	<p>VOLUME 2, Chapter 5, Section 4.3.2, P5-12 of ERMP</p> <p>Dot point 2 – this commitment needs to be clearly defined. That is, what constitutes ‘periodic’ and specifically what does ‘ecological monitoring’ entail?</p> <p>Dot point 4 – Understood that ‘summer’ as determined by Worsley is from 1 December to 31 March each year. Needs agreed clarity.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	See response to item 49.
51	<p>VOLUME 2, Chapter 5, Section 4.7, P5-15 of ERMP</p> <p>Last dot point – frequency of this program and parameters monitored need to be detailed.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	See response to item 49.

Item	Submission	Response
52	<p>VOLUME 2, Chapter 5, Section 4.7, P5-16 of ERMP</p> <p>Dot point 3 – the operating strategy for the fresh water lake needs to include EWR requirements. The EWR report commissioned by Worsley has not been provided to DoE.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Worsley will provide a report on the Environmental Water Requirements to DoE when complete, as explained in item 40. Development of an operating strategy will be a requirement of the abstraction licence and does not form part of the ERMP process.</p>
53	<p>VOLUME 2, Chapter 5, Section 4.8, P5-16 of ERMP</p> <p>Historical and annual water usage data does not appear to have been provided in previous reports. Worsley need to include this information in the AER. Water usage data from the FWL and the RCL should be provided in support of the application currently before the DoE to increase their licensed entitlement.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. Water usage has been reported in Worsley's Public Health, Safety, Environment and Community Report and will be included in the Annual Environmental Reports.</p>
54	<p>Other Comments</p> <p>Air emission impacts on nearby water bodies of regional/state significance (Stirling, Harris and Wellington dams) are likely to be insignificant, but an attempt/commitment to assess/investigate this matter should be made.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>See response to item 73.</p>
55	<p>Appendix 8, Emissions Inventory</p> <p>See attached (Attachment 1) extract from draft refinery EAR. Eg, Tables 2 and 3 and associated text.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. The matter is to be addressed by EP Act Part IV licensing requirements.</p>
56	<p>Page 3-30 of Volume 2 in the Existing Commitments:</p> <p>The conditions of approval should be consistent or improved over former environmental approvals issued for Alcoa World Alumina Australia's (Alcoa) mining operations. There are two areas to consider:</p> <p>Water quality</p> <ul style="list-style-type: none"> <li>• local impact from refinery and conveyance system; and</li> <li>• water resource impact from dry land salinity due to temporary clearing of the forest.</li> </ul> <p>Water quantity</p> <ul style="list-style-type: none"> <li>• increase during clearing and mining; and</li> <li>• potential decrease due to over-dense rehabilitation.</li> </ul> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 34.</p>

Item	Submission	Response
57	<p>Research in the higher rainfall areas in Wungong Catchment show that Alcoa's mining rehabilitation is using more water than the regrowth forest it replaced. There is uncertainty if this pattern will continue, or how this translates to the lower rainfall areas that Worsley want to mine, but it raises concerns about Worsley's rehabilitation. The Worsley proposal document focuses on water quality, but not much on water quantity.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Worsley's rehabilitation program has to date focussed on restoring values compatible with forest surrounding existing mining operations located at Saddleback. As rehabilitation occurs in areas having different requirements, the rehabilitation prescription and management process will be altered accordingly and in consultation with key stakeholders including the Water Corporation, DoE, CALM and the EMLG. The adaptive rehabilitation program is demonstrated by Worsley's development of rehabilitation prescription suitable for agricultural land disturbed by mining operations.</p>
58	<p>Prior to the proposal being implemented, there needs to be a clear demonstration, based on field measurement and modelling, that there will be no significant impact on stream flow and salinity from mining and rehabilitation activities and other contaminants.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Worsley has committed to intensifying its water resources investigations and incorporating these investigations in a 10-15 year mine planning horizon.</p>
59	<p>Modelling is required in relation to impacts on stream flow and salinity by mining operation and rehabilitation using a hydrological model approved by the Department of Environment (DoE) prior to work commencing. Outcomes from this modelling can then be used to determine the water impacts and under what conditions mining can proceed, if at all.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 33.</p>
60	<p>Page 3-42 of Volume 1 in the list of issues to be covered by rehabilitation plan: This needs to include water criteria for mining operations and rehabilitation. Monitoring of streams and bores is required downstream of the refinery and mining areas with sites established under the guidance of DoE. Existing hydrological monitoring should be used and new monitoring established where required. Some relevant stream gauging has been discontinued and Worsley will need to fund its refurbishment and ongoing operation with possible financial assistance from DoE. This should include groundwater bores drilled to bedrock at approx 1km intervals to measure water table and salinity (including seasonal response) in the drinking water catchments before, during, and after mining. Monitoring should also include measurement of stream flow and quality (including salinity and turbidity) at least at:</p> <ul style="list-style-type: none"> <li>o S616002 – Mundaring Catchment, Darkin River Pine Plantation (open from 1968);</li> <li>o S616039 – Canning Catchment, Millars Road, (open 1973 – 1999); and</li> <li>o S614035 – Serpentine Catchment, River Road, (open 1982 – 1999).</li> </ul> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 57 regarding Worsley's rehabilitation program.</p> <p>Monitoring bores have been in place around and downstream of the refinery and have been operational since refining operations began. These bores are established under requirements of the Agreement Act and results are reported annually in the Annual Environmental Report. As new facilities, in particular residue disposal areas, are established within the refinery lease area, new bores are commissioned. Similarly, monitoring of water quality and flow downstream in the Augustus River has been undertaken since refinery operations began. At the Boddington bauxite mine, regional monitoring of both groundwater and surface water is undertaken. Results are reported in the Annual Environmental Report. Both refinery and mining area water monitoring programs will continue for expanded operations, to the requirements of the DoE.</p>
61	<p>Worsley should prepare management strategy scenarios for mitigating impacts on stream flow and water quality to the satisfaction of the Water Corporation and DoE before work commences – taking into account cumulative impact on drinking water catchments now and into the future by Worsley and Alcoa mining in low rainfall areas.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Worsley's existing management programs aimed at mitigation of impacts on local water resources are periodically reviewed as necessary due to change in mining operations and movement into new mining areas. Worsley has committed to developing and implementing mitigation measures in the ERMP and will consult with key stakeholders through the EMLG as required in the development of all water resources management plans and measures.</p>
62	<p>Working arrangements need to be developed and implemented with DoE (page 50 of Executive Summary) and the Water Corporation should contribute to these.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Noted. The Water Corporation, through the Bunbury Regional Office, has provided input into Worsley's early development of these working arrangements.</p>

Item	Submission	Response
63	The Water Resource Management Plan should be made available publicly. (Water Corporation, received 10 August 2005)	Noted.
64	The proponent should monitor stream flow and water quality (salinity, turbidity, nutrients, dissolved carbon, pathogens, heavy metals and hydrocarbons) downstream of the refinery and mining works. (Water Corporation, received 10 August 2005)	See response to item 60 regarding monitoring.
65	Stream buffers should be as per the Forest Management Plan by the Conservation Commission of Western Australia. Worsley should also consider becoming involved in the research on the effectiveness of stream buffers in protecting water quality and quantity. This work is being co-ordinated by the Department of Conservation and Land Management. (Water Corporation, received 10 August 2005)	Worsley has committed to the management of stream buffer areas in public water supply areas as one of the management measures for protection of water resources (Volume 1, Chapter 3, Section 4.4.4).
66	Worsley should model and analyse [water] monitoring results and report to stakeholders (including DoE and Water Corporation). (Water Corporation, received 10 August 2005)	All monitoring results are presented in Worsley's Annual Environmental Report that is reviewed by the EMLG and made publicly available.
67	Mine site inspections by Water Corporation rangers are required once per week in winter and once per month in summer. This is to monitor operations and look for potential contamination of water quality and to ensure that stream buffers are being maintained. (Water Corporation, received 10 August 2005)	Worsley will comply with standard inspection requirements as required within public drinking water supply areas.
68	Appropriate management plans and road controls should be implemented to ensure unnecessary access to drinking water catchments by Worsley staff and the public is minimised during mining operations. (Water Corporation, received 10 August 2005)	Access through all mining areas by both the public and Worsley personnel is strictly controlled in accordance with Mine Safety Regulations. Worsley also has procedures for controlling access of operational personnel to required areas only. Examples of these procedures are for strict control to minimise the risk of spread of forest disease and protection of heritage sites. Similar procedures will apply to access and movement within public drinking water supply areas.
69	Wastewater management should occur outside of drinking water catchments wherever possible. If it is conducted inside a catchment, there must be a mutually agreeable standard between Worsley, the Water Corporation and the DoE. (Water Corporation, received 10 August 2005)	Noted. Details of such control mechanisms to be developed in working arrangement for operations in public water supply areas and in consultation with key stakeholders.
70	Management practices should be adapted as required in response to the analysis and review of the [water] monitoring results. This response should include an option of stopping future work if required. (Water Corporation, received 10 August 2005)	Worsley's existing management programs aimed at mitigation of impacts on local water resources are periodically reviewed as necessary due to change in mining operations and movement into new mining areas. Worsley has committed to developing and implementing mitigation measures in the ERMP and will consult with key stakeholders through the EMLG as required in the development of all water resources management plans and measures.
71	Page 1-18 of Volume 1: The State Water Strategy has been missed from this list, which has Brunswick River as a potential 30 gigalitre per year water source. (Water Corporation, received 10 August 2005)	Noted.

Item	Submission	Response
72	<p>Page 5-72 of Volume 1: While the Water Corporation is not currently using the Brunswick River (having moved away from Beela Dam), this source is part of the Corporation's future mix of water resources. Hence any impacts on water quality or quantity, such as increasing the height of Worsley's dam, needs to consider that this river may be used as a future major water source for the Integrated Water Supply Scheme. This should include consideration of water allocation planning and environmental water provisions. (Water Corporation, received 10 August 2005)</p>	<p>Any development of Environmental Water Provisions for this system by the DoE will take into account water resource allocation.</p>
73	<p>Will fallout of particulates contaminate the Harris Dam drinking water? (Shire of Collie, received 10 August 2005)</p>	<p>Modelling of particulate emissions has been undertaken for existing and expanded refinery operations and assessed on the basis of potential impacts on public health. Discussion on changes in particulate emissions in Volume 1, Chapter 5, Section 2 of the ERMP highlights that particulate emissions are well below the National Environmental Protection Measure Guideline and that there is no significant difference in the maximum PM<sub>10</sub> and PM<sub>2.5</sub> concentrations arising from existing and expanded refinery operations. The modelling also predicts that the other regional power stations are producing PM<sub>10</sub> ground level concentrations at representative receptors that are an order of magnitude higher than produced by the refinery expansion alone.</p> <p>Given the negligible increase in ground level concentration of particulates due to the expansion it is considered unlikely that any change in impact on the Harris Dam drinking water supply will occur due to the expansion. Worsley acknowledge that modelling of dispersion of particulates has not included sources that may arise from the drying residue storage areas. Worsley has committed in the ERMP to undertaking modelling and assessment of potential impacts from these sources as part of its ongoing Air Emissions Impact Assessment project. This assessment will include and evaluation of potential impacts on the Harris River Dam including both its catchment and the actual water body.</p>

#### 4.2.6 Air emissions

Item	Submission	Response
74	<p>Overall, the ERMP and supporting documents are considered to represent a high quality of work. Issues pertaining to health are well addressed, with the assessment methods adopted being generally well justified. Of principal importance to the DOH, the HRA evaluated the potential for air emissions attributable to the Worsley refinery expansion to cause direct adverse effects on public health. A screening assessment approach was adopted that compared predicted short-term and long-term ground level air pollutant concentrations (GLCs) with recognised health based guideline values. Predicted short-term GLCs were also used to assess the potential for malodour and sensory irritation.</p> <p>Ambient air quality modelling was used to predict GLCs at more than 30 discrete receptor locations for several operating scenarios. The following scenarios were considered by the HRA:</p> <ul style="list-style-type: none"> <li>• S1 – The refinery as it is currently operating</li> <li>• S2 – The refinery operating after the proposed expansion</li> <li>• S3 – Cumulative emissions with coal fired power stations</li> </ul> <p>The DOH relies on the expertise of the Department of Environment to assess the suitability of the modeling methods employed.</p> <p>The methods adopted by the HRA are considered conservative and unlikely to result in an under-estimation of potential health risks. DOH concerns pertaining to the HRA are negligible and do not affect the validity of the conclusions made by the report. Notably, the DOH concurs with the conclusion that the predicted air emissions are unlikely to significantly contribute to adverse health effects in the Collie region. However, as the Worsley refinery will contribute to emissions within the Collie air-shed, it is recommended that Worsley Alumina participate appropriately in air quality management strategies that may be developed for the area.</p> <p>(Department of Health, received 9 August 2005)</p>	<p>Noted. Worsley is willing to participate in any Collie area air quality management program.</p>
75	<p>VOLUME 1, Chapter 1, Table 1.4, p 1-23 of ERMP</p> <p>The “na” under “current approved project” for CO and Total VOCs is insufficient. A figure should be provided (however qualified), as these are important indicators. The Version 1 inventory should contain enough data to derive these numbers, even with qualifications. “Total VOCs” and “VOCs” should be carefully defined and standardised throughout the ERMP documentation. Footnote “2” “excluding fugitive sources” is a significant qualification.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Table 1.4 is reflective of the existing project key characteristics. It should be noted that the current Ministerial Approval does not contain a key characteristics table and that this table has been developed from the text of the Consultative Environmental Review (CER) documentation. The column titled Current Approved Project may be considered as the interpretation of project key characteristics associated with Ministerial Statement 423. Where “na” is included in the table, this indicates that there were no data available in the CER document. Estimates of CO and VOC emissions are provided in the column titles Current Production and are derived from the Version 1 emissions inventory as suggested by the comment.</p>
76	<p>VOLUME 1, Chapter 1, Section 4.3.1, p 1-35 of ERMP</p> <p>The comments about the importance of VOCs and the improved removal efficiency of the RTOs for this parameter, underlines the importance of the preceding comment.</p> <p>It states that at existing production levels one of the 2 RTOs is “operational and the other on standby”. Does this also apply to 4.4 mtpa? This question should be answered here.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>The digestion area RTOs have been designed with adequate capacity to control emissions from the area at 4.4 Mtpa. The operating philosophy of the RTOs has been changed to have both units operational at the same time (running at reduced capacity) so as to maintain continuous treatment in the event that one unit shuts down for any reason.</p>

Item	Submission	Response
77	<p>VOLUME 1, Chapter 1, Section 4.3.2, p 1-37</p> <p>The “flue gas desulphurisation” (fgd) type technology referenced here and elsewhere, is likely to be best practice. Notwithstanding this, more detail should be given as to what the specific technology consists of (eg wet scrubber?), and the additional wastewater and solid waste streams that it generates, and how these streams will be managed. Being new technology it needs further detail (although the greatest detail should accompany the Part V Works Approval application). Also, has the additional water resourcing required for the fgd been taken into account in the project water budget?</p> <p>Worsley should be congratulated on installing this technology, where others (eg Bluewaters PS- Bulletin 1160, p16) have not.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>For the purpose of assessing the impact of increased emissions to air due to the expansion, flue gas desulphurisation has been assumed to remove 60% of SO<sub>2</sub> from stack emissions. This rate of removal is not considered to be best practice, that would typically remove in excess of 90% of SO<sub>2</sub>. The lower rate of SO<sub>2</sub> removal has been assumed for a scrubbing system using a caustic bauxite residue stream as used in an overseas alumina refinery. This system has the added benefit of reducing CO<sub>2</sub> in the flue gas stream. It has been assumed, and confirmed from discussion with DoE officers that a system that removes some CO<sub>2</sub> and SO<sub>2</sub> may be of greater benefit than a system that removes an increased amount of SO<sub>2</sub> and increases CO<sub>2</sub> (note that any benefits that this system may show in reducing CO<sub>2</sub> have not been taken into account in the estimation of project greenhouse emissions).</p> <p>It needs to be noted that this flue gas desulphurisation system is not currently in use at a scale relevant to Worsley. Any final decision of the type of flue gas desulphurisation will take into account proven technologies at a scale suitable for the refinery.</p> <p>No analysis of the increased reagent and water requirements of any flue gas desulphurisation system has been undertaken so far. As required, these details will be provided in the necessary works approval application.</p>
78	<p>VOLUME 1, Chapter 5, Section 1.2.1, p 5-2 of ERMP</p> <p>Under coal fired option, it is important to note that emissions would increase despite the use of BP pollution control technology for all new equipment. Existing (coal and gas) power generation and alumina processing equipment may not necessarily use BP (ie by retrofitting it).</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. Text explaining emission changes for the coal fired option on p5-2 states emissions will increase for the coal fired expansion.</p>
79	<p>VOLUME 1, Chapter 5, Table 5.1, p5-6 of ERMP</p> <p>Regarding footnote for “1”- It is understood that the numbers in the table could be considered “health based guidelines” in that NEPM guidance documents say they represent a ‘level of concern’ for the protection of human health (ie a target) and justifying further investigation.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted.</p>
80	<p>VOLUME 1, Chapter 5, Table 5.2, p 5-7 of ERMP</p> <p>The Mercury value is a “guideline for inorganic mercury vapour”, which does not necessarily include all forms of mercury (eg that attached to particulates).</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted.</p>
81	<p>VOLUME 1, Chapter 5, Table 5.2, p 5-7 of ERMP</p> <p>The WHO guideline value for acetaldehyde (of 2000 micrograms per m<sup>3</sup>) could have been included, as the emissions inventory indicates it is a substance of interest for several emission points. The most significant emitter of acetaldehyde is Calcination- will the BP baghouse (for Calciner 6) be sufficient to deal with acetaldehyde emissions? [see attached extract (Attachment 1) from draft refinery EAR].</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted.</p>



Item	Submission	Response
82	<p>VOLUME 1, Chapter 5, Section 2.5, p5-15 of ERMP</p> <p>The statement made about the significance of CO and VOCs should be read in context of the points made against Table 1.4 in chapter 1.</p> <p>The comment about PAHs, dioxins and furans is not relevant as the emissions inventory has shown them to be low output and low to no risk [see attached extract from draft refinery EAR].</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.
83	<p>VOLUME 1, Chapter 5, Section 2.5.1 2nd para, p5-15 of ERMP</p> <p>The inventory does not yet include CrVI, which may or may not be significant, but thought significant enough to be included in subsequent inventory work.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Worsley has committed to undertake speciation work for chromium as part of the Air Emissions Impact Assessment. CrVI has been included in the Health Risk Assessment (HRA) using National Pollutant Inventory (NPI) derived estimated for CrVI speciation (ie 5%).
84	<p>VOLUME 1, Chapter 5, Section 2.5.1 last para, p5-15 of ERMP</p> <p>Although Worsleys proactive air improvement programme is to be applauded, there are still gaps- eg commitment to retrofitting BP to "old" Calciners.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.
85	<p>VOLUME 1, Chapter 5, Section 2.5.1 Table 5.6, p5-16 of ERMP</p> <p>A table of high ranked total emission rates does not necessarily include/exclude all substances of significance/interest (some substances are toxic at low emission rates/concentrations), an issue addressed/raised in Toxicos HRAs.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	As indicated in issues raised, the HRA has taken into account numerous substances and has applied a rigorous approach to identifying and taking into account all significant substances. Approximately 260 substances have been identified by the Worsley emissions inventory. Many of these substances have been identified in tiny concentrations and considered as substances of no toxicological concern. Some 64 chemicals have been identified as of potential concern and evaluated in the HRA.
86	<p>VOLUME 1, Chapter 5, Section 2.6, from p5-16 of ERMP</p> <p>The comments regarding improved pollution control on the LBF have not been yet confirmed for when the LBF is operating at normal throughput for an extended period. Find attached (Attachment 2) a review of the final commissioning report for the LBF, dated 04/07/05. With minor qualifications, the information to date though indicates that the LBF is performing as designed.</p> <p>The comment subsequently made about the baghouse and SO2 scrubber, and baghouse being best practice for respectively the power station and Calciner 6, need clarification (including comment from AQD). Is it proved BP, where has it been used before, etc?</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted. The comment regarding the baghouse relates to installing these control equipment "in line with best practice" on the basis that using baghouse filters in particular can be considered to give better performance than existing electrostatic precipitators for both the coal fired power station and in calciners. Vendor specifications for these control equipment will require the adoptions of best practice equipment. These specifications and performance criteria will be included in subsequent works approval applications.
87	<p>VOLUME 1, Chapter 5, Table 5.7, p5-18 of ERMP</p> <p>Reg. Digestion- The proposed emission reduction system has not been commissioned or tested yet, so the % improvements are not proved.</p> <p>Reg. Product filtration (includes Calcination)- The comments do gloss over a little, the significance of Calcination for emissions, both with the additional Calciner, but ALSO additional throughput through the existing Calciners. [see attached extract from draft refinery EAR for concerns regarding Calcination]. No commitment is given to upgrade pollution control on existing Calciners.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted. Although it should be noted that these control targets are specifications for the control system. No change in throughput for existing calciners 1-5 are proposed for the expansion. All additional calcination capacity will be provided by the proposed calciner 6 that contains improved emission control systems. Emissions from existing calcination facilities will continue to be assessed and managed as part of the Air Emissions Impact Assessment program.

Item	Submission	Response
88	<p>VOLUME 1, Chapter 5, Table Table 5.8, p5-19 of ERMP</p> <p>Assumes again that the Digestion and LBF upgrades are in place and operating as intended (insufficient data to prove this assumption). This table highlights the significant increase in all parameters for the coal fired option and the advantages of gas as fuel.</p> <p>Minimal apparent change in Benzene levels, which confirms the Inventory finding that 94 % of this substance is emitted from Calcination.</p> <p>Note: the footing note gives “2” = “toxic equivalents” without “2” appearing in the table.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted. Toxic equivalents should apply to total dioxins and furans.
89	<p>VOLUME 1, Chapter 5, Section 2.1.1 Worsley inventory of ERMP</p> <p>See Table 3 in attached extract from draft refinery EAR (Attachment 1).</p> <p>The use of the “other” power station emissions data is questionable, given the number of qualifications.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	The EAR notes the complexity of emission source characterisation. Use of “other” power station emissions data was done according to publicly available information for these existing and proposed facilities.
90	<p>VOLUME 1, Chapter 5, Sections 2.7.2 – 2.8.3 inclusive of ERMP</p> <p>It would be useful to define the “Collie Airshed” (in which the refinery lies) to know how much of the airshed carrying capacity has “been used” under different scenarios. Nonetheless, the Worsley contribution to the airshed appears to be low and the assessment methodology suitably conservative.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	The “Collie Airshed” is used as a generic term for the Collie region. Modelling has been done for gridded receptors within 15 km from the Worsley refinery, and also for receptors in the vicinity of the Collie A and Muja power stations located some 30 km from the refinery.
91	<p>VOLUME 1, Chapter 5, Table 5.15 of ERMP</p> <p>The Arsenic value under the expansion is close to the given guideline value, which although it does comply with the Statement “comply with recognised guidelines” doesn’t give a high level of comfort and justifies further examination and perhaps a plot as per Figures 5.9, 5.10 and 5.11. The other modelled substances are all well below guideline values.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted. Arsenic has been included in the Health Risk Assessment for carcinogenic risks that are calculated to be below the acceptable range for public health.
92	<p>VOLUME 1, Chapter 5, Section 2.10.1 of ERMP</p> <p>Is a bag house for Calciner 6 BP ? (AQB ?). The reference to investigating emission variability in Calcination and “emission control measures for existing equipment” are important and should be confirmed by a Worsley commitment (see below) and in the EPA conclusion.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	See response to item 86 above.
93	<p>VOLUME 1, Chapter 5, Section 2.12, p5-60 of ERMP</p> <p>In Worsley’s consolidated commitments first dot point, it should read “VOC emissions from calcination”. It is assumed that “VOC” includes benzene and other Btexs, as per the Inventory.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.

Item	Submission	Response
94	<p>VOLUME 2, Chapter 5, Section 2.1 of ERMP</p> <p>Talks of major point sources. The BRDAs are not point sources, rather broadscale/diffuse. Similarly the BRDA lifts could not really be considered a "new large air emission source", as the increase in volume is not equalled by a significant increase in surface area. Nonetheless, they present a potentially significant odour/particulates source not quantified in the Version 1 Emissions Inventory. Another potentially significant odour source not mentioned here or quantified in the Version 1 Emissions Inventory is the refinery catchment lake (ie large, warm, contaminated water body).</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.
95	<p>VOLUME 2, Chapter 5, Section 2.3.2, P5-4 of ERMP</p> <p>In Worsley's consolidated commitments first dot point it should read "VOC emissions from calcination".</p> <p>It is assumed that "VOC" includes benzene and other Btexs, as per the Inventory.</p> <p>It would be justified and useful (&amp; Worsley is known to have commenced this) to include a specific commitment to establishing a Continuous Emissions Monitoring System (CEMS) for the significant emission points.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted regarding VOC emissions from calcination.</p> <p>VOC represents total VOC, benzene and Btexs.</p> <p>Continuous emissions monitoring is considered to be addressed by licensing requirements.</p>
96	<p>Appendix 10 (Health Risk Assessment) of ERMP</p> <p>The report concludes, somewhat equivocally, that odour impact on neighbourhood amenity for the present refinery, "...shows a high likelihood for odour events to be experienced by nearby communities..." and "... this however is not borne out by experience" (ie lack of complaint) and "...points to over estimation of ground level odour concentrations..." The report goes onto comment that "...it is unlikely that local amenity will be impacted by odour from the extended Worsley refinery..." (ie to 4.4 mtpa). All these comments are equivocal, although the lack of recent complaints regarding odour could endorse the conclusion.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Refer to response to item 99.
97	<p>Appendix 10 (Health Risk Assessment) of ERMP</p> <p>The report also concludes that "overall there is a medium to high degree of confidence that the emissions from the Worsley refinery expansion are unlikely to cause direct acute or chronic health effects on the surrounding population". This conclusion appears defensible given the conservative assumptions used all the way through.</p> <p>The above conclusion relates to the completion of some works, which will improve emission quality. Some uncertainties though are associated with this conclusion, and are related to; fugitive emissions from the BRDAs (both odour/VOCs and particulates) and the refinery catchment lake and solar evaporation ponds (both odour/VOCs), and lack of data to address the variability of refinery emissions (although it could be argued that the conservatism of the HRA accounts for this).</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	The refinery Air Emissions Impact Assessment will be continuing and is addressing fugitive source as part of updating the refinery emissions inventory. This work will continue to be communicated through the government coordinating committee, refinery CLC, EMLG and through Annual Environmental Reporting.
98	<p>Will fallout of particulates contaminate the Harris Dam drinking water?</p> <p>(Shire of Collie, received 10 August 2005)</p>	See response to item 73 where issue is addressed under water resources sub-heading.

Item	Submission	Response
99	<p>Chapter 5 of ERMP Assessment of odour.</p> <p>The ERMP, specifies an odour criterion in Table 5.2 as follows: 3-minute 99.5 percentile 5 OU/m<sup>3</sup> "screening criteria", with a stated reference "WEC (2003) based on WA EPA (2002)". There is a brief description on page 5-8 of the supposed source of this criterion.</p> <p>The criterion was in fact first proposed by Welker Environmental Consultancy, August 2002, in a report "Assessment of odour from Liquor Burner". Odour intensity for gas sampled from the Liquor Burner only for one day only was assessed by the University of NSW via a method "not strictly in accordance with the VDI (1993) Standard but still acceptable for use in determining a preliminary odour intensity/odour concentration relationship". The 4.9 OU was determined to be the "distinct" concentration. The statement was then made "The EPA's odour criterion in relation to liquor burner odours ... is 4.9 OU, 3 minute average, 99.5 percentile in one year's data."</p> <p>Points of correction are required here.</p> <p>(a) It is not EPA's criterion, it is Worsley's application of EPA's guidance for deriving a criterion, and EPA could reasonably question the uncertainty of the 4.9 value.</p> <p>(b) EPA guidance 47 (ignoring its recent withdrawal) does not permit application of the ii(b) "distinct" criterion (3 minute 99.5%) to tall wake-free stacks. A case-specific assessment considering peak to mean ratios is required – this would inevitably yield a scaled down criterion for tall stack emissions (at least 50% smaller odour concentration).</p> <p>Welker (2002) proceeded to describe work undertaken (analysis of odour notifications by residents and 1-hour average modelling) to determine "the minimum odour concentration which may result in odour annoyance" (page 15, Section 9). The resultant odour criterion was 0.9 OU 1-hour average, 99.9 percentile. Welker (2002) noted that this was "more than 5 times more stringent" than the "EPA's criterion" above. Noting the above explanation re tall stacks, "5 times" is an overestimate, but the message is clear:- the 5 OU 3-minute 99.5% was/is not protective in relation to liquor burner odours.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>(a) The reason for the use of the (preliminary) liquor burner intensity for district odour (4.9 OU) was our concern that Australian odour laboratory's measurements of odour intensity were not in accordance with the VDI (1993) standard. The reasons for these concerns are described in Pitt (2003). As such, the results of intensity analyses for other (than the liquor burner) refinery odour sources more typical of future odour impacts (due to RTO) could be highly misleading and counter-productive for resolving odour issues.</p> <p>Data of intensities for alumina refinery odour sources (Jiang et al 2005) obtained using methods much closer to the VDI (1993) method, published after the ERMP indicates that:</p> <ul style="list-style-type: none"> <li>• The liquor burner distinct odour concentration of 4.9 OU used in the Worsley ERMP is lower than the 7 OU for liquor burner odours from other refineries; and</li> <li>• The distinct odour concentration for calciner odours which, with the odour controls proposed for Worsley, are likely to be the dominant odour source are slightly higher again at about 7.5 OU.</li> </ul> <p>Therefore, the use of 4.9/5.0 OU as the indicator of distinct odours from the Worsley expansion, in this respect, appears to embody some conservatism.</p> <p>(b) Assuming adequate reliability of the liquor burner RTO, the remaining refinery odour sources will all be wake-affected or area emissions. Therefore, the EPA's criteria should be adequate without any modifications to account for peak concentrations from tall, wake-free sources.</p> <p>It is considered that the potential for odour impacts from the liquor burner (for example, should there be uncontrolled emissions from the liquor burner) should be treated differently to odours from the other refinery sources, including consideration of short-term peak concentrations (ie tall wake-free sources) and using an odour impact criteria more stringent than the EPA's district based criterion (eg the 0.9 OU 1-hour average, 99.9 percentile mentioned below – also see related comments below).</p> <p>It accepted that "the 5 OU 3-minute 99.5% was/is not protective in relation to liquor burner odours". However, given that liquor burner odours are negligible (with RTO control) and therefore, the remaining refinery odours have quite different characteristics, it is considered that this criterion may well be adequately protective in this context (ie for the proposed expansion).</p>
100	<p>Chapter 5 of ERMP</p> <p>Results of odour modelling show a slight exceedance of the criterion at one residence. Inclusion of odours from the BRDAs and cooling lake may increase odour impacts.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	See response to item 101.
101	<p>Chapter 5 of ERMP</p> <p>Recommend that, if the EPA receives commitments from WAPL to proceed with odour emission quantification, field odour assessment and odour reduction as necessary to achieve and maintain acceptable odour levels, then approval is appropriate.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	Worsley has made commitments through its Air Emission Impact Assessment program to undertake these works.

Item	Submission	Response
102	<p>Chapter 5 of ERMP</p> <p>Particulates as PM<sub>10</sub> or PM<sub>2.5</sub></p> <p>We have been aware that Worsley did not assess dust impact from BRDAs, stockpiles etc in the timescale of the ERMP because, as we were informed:</p> <ol style="list-style-type: none"> <li>1) the upgrade will not increase the total RDA land area;</li> <li>2) there is not an existing dust problem according to Worsley;</li> <li>3) there will be improved dust management practices associated with the upgrade;</li> <li>4) Worsley has committed to TEOM campaign monitoring in the vicinity of the RDAs;</li> <li>5) dust emissions quantification and dust dispersion modelling, including deposition, is problematic</li> </ol> <p>AQD agrees that modelling of dust is problematic and generally has large associated uncertainty. For nuisance dust we consistently recommend focus on effective management programs, verified by monitoring, with modelling finding its main use as a means to assess/compare improvement options (still with uncertainty).</p> <p>WAPL's scoping document (Final, Nov 2004) nevertheless indicates that dust emissions from the BRDAs will be quantified and modelled. Refer to Table 10 in Strategen 2004.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>See response to item 103.</p>
103	<p>Chapter 5 of ERMP</p> <p>It is likely that that the PM<sub>10</sub> modelled concentrations are under-predicted because sources such as the BRDAs are not included. We recommend that quantification of PM<sub>10</sub> concentrations and recalculation of the hazard index should be carried out to present the full picture.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Subsequent estimation of particulate matter from residue disposal areas has been undertaken. Estimated emission rates have also been used to model dispersion of particulate matter cumulatively with other refinery and regional particulate emission sources according to the methodology previously employed. Results from particulate modelling have been used to recalculate hazard indices at potentially sensitive receptors.</p> <p>Estimation of particulate emission and dispersion modelling has been carried out by Pacific Air &amp; Environment. Recalculation of hazard indices has been undertaken by Toxikos. Copies of these will be made available to the DoE's Air Quality Division and EPA. It should be noted that these works are proposed to be ongoing as a key aspect of the refinery Air Emission Impact Assessment program, with emission estimation and modelling methodology being updated and verified as more accurate monitoring data becomes available from the recently installed TEOM (tapered element oscillating microbalance) monitoring system and the planned additional monitoring station to be installed remote from the refinery.</p> <p>A summary of findings is as follows.</p> <p><i>Estimation of particulates arising from residue disposal areas.</i></p> <p>Estimates of emissions from residue disposal areas indicate that activity based emissions, in particular wheel generated dust, represents the predominant source of dust from the whole residue disposal area (i.e. facilities and surrounding area and activities) comparative emission rates are shown in the following table.</p>

Item	Submission	Response																							
		<table border="1"> <thead> <tr> <th></th> <th colspan="3">Estimated emission rate (g/s)</th> </tr> <tr> <th>Emission source</th> <th>Total suspended particulates</th> <th>PM<sub>10</sub></th> <th>PM<sub>2.5</sub></th> </tr> </thead> <tbody> <tr> <td>Wind erosion</td> <td>5.0</td> <td>2.5</td> <td>1.0</td> </tr> <tr> <td>Activity based emissions (eg construction works)</td> <td>74.8</td> <td>20.7</td> <td>3.7</td> </tr> <tr> <td>Total</td> <td>79.8</td> <td>23.2</td> <td>4.7</td> </tr> </tbody> </table>					Estimated emission rate (g/s)			Emission source	Total suspended particulates	PM <sub>10</sub>	PM <sub>2.5</sub>	Wind erosion	5.0	2.5	1.0	Activity based emissions (eg construction works)	74.8	20.7	3.7	Total	79.8	23.2	4.7
	Estimated emission rate (g/s)																								
Emission source	Total suspended particulates	PM <sub>10</sub>	PM <sub>2.5</sub>																						
Wind erosion	5.0	2.5	1.0																						
Activity based emissions (eg construction works)	74.8	20.7	3.7																						
Total	79.8	23.2	4.7																						
		<p><i>Modelling of dispersion of particulates from residue disposal areas.</i></p> <p>The modelled dispersion of PM<sub>10</sub> from residue disposal areas shows</p> <ul style="list-style-type: none"> <li>○ 24 hr concentration exceeds the NEPM goal over the immediate vicinity of the residue disposal areas (within the refinery lease area)</li> <li>○ The NEPM standards are not exceeded at any of the identified sensitive receptors</li> </ul> <p>The modelled dispersion of PM<sub>2.5</sub> from residue disposal areas shows.</p> <ul style="list-style-type: none"> <li>○ Annual average PM<sub>2.5</sub> is within the advisory reporting standard</li> <li>○ Maximum 24 hr concentration exceeds the advisory reporting standard over the immediate vicinity of the residue disposal areas (within the refinery lease area)</li> <li>○ The NEPM advisory reporting standard will not be exceeded at any of the identified receptor locations.</li> </ul> <p>Modelling has also been undertaken simultaneously with refinery emission sources and regional sources to determine the cumulative impacts at sensitive receptor locations. The 24 hr concentration of PM<sub>10</sub> does not exceed the NEPM goal (allowing for five exceedances per year), while the 24 hr concentration of PM<sub>2.5</sub> exceeds the advisory reporting standard, mostly to the southeast of the refinery where the impacts of Muja and Collie power stations is most likely. The refinery expansion is considered to have no significant effect on concentrations at sensitive receptors.</p> <p><i>Recalculation of hazard indices.</i></p> <p>General findings are that</p> <ul style="list-style-type: none"> <li>○ Ground level concentration of PM<sub>10</sub> and PM<sub>2.5</sub> markedly increase when cumulative emissions from regional power stations area included</li> <li>○ Residue disposal areas appear to contribute significantly to total airborne particulates arising from the refinery</li> <li>○ The PM<sub>2.5</sub> to PM<sub>10</sub> ratio increases from 20% at receptors close to the refinery from 80-100% in the cumulative scenario including regional sources at receptors far (to the north and northwest) from the refinery – consistent with fine particle impact primarily being associated with power station emissions.</li> </ul> <p>Acute hazard indices have been re-calculated from maximum ground level concentrations of criteria pollutants at receptors 18 and 21, located to the north north-west of the refinery, where impacts from both the refinery and regional sources can occur at the same time. The change in hazard indices is shown in the following table.</p>																							

Item	Submission	Response																												
		<table border="1" data-bbox="1099 268 2094 440"> <thead> <tr> <th data-bbox="1099 268 1240 300">Receptor</th> <th colspan="2" data-bbox="1240 268 1525 300">Existing scenario (S1)</th> <th colspan="2" data-bbox="1525 268 1816 300">Expanded refinery (S2)</th> <th colspan="2" data-bbox="1816 268 2094 300">Expanded and cumulative sources (S3)</th> </tr> <tr> <td data-bbox="1099 300 1240 331"></td> <th data-bbox="1240 300 1382 331">ERMP</th> <th data-bbox="1382 300 1525 331">Recalc</th> <th data-bbox="1525 300 1666 331">ERMP</th> <th data-bbox="1666 300 1816 331">Recalc</th> <th data-bbox="1816 300 1957 331">ERMP</th> <th data-bbox="1957 300 2094 331">Recalc</th> </tr> </thead> <tbody> <tr> <td data-bbox="1099 331 1240 363">18</td> <td data-bbox="1240 331 1382 363">0.45</td> <td data-bbox="1382 331 1525 363">0.63</td> <td data-bbox="1525 331 1666 363">0.5</td> <td data-bbox="1666 331 1816 363">0.69</td> <td data-bbox="1816 331 1957 363">0.75</td> <td data-bbox="1957 331 2094 363">1.24</td> </tr> <tr> <td data-bbox="1099 363 1240 395">21</td> <td data-bbox="1240 363 1382 395">0.68</td> <td data-bbox="1382 363 1525 395">0.96</td> <td data-bbox="1525 363 1666 395">0.72</td> <td data-bbox="1666 363 1816 395">1.00</td> <td data-bbox="1816 363 1957 395">1.1</td> <td data-bbox="1957 363 2094 395">1.27</td> </tr> </tbody> </table> <p data-bbox="1099 448 2094 520">Hazard indices increase due to the effects of the residue disposal areas and are greater than unity for the cumulative scenario. The hazard indices for the 99.5<sup>th</sup> percentile concentrations (not presented above) are all less than unity.</p>	Receptor	Existing scenario (S1)		Expanded refinery (S2)		Expanded and cumulative sources (S3)			ERMP	Recalc	ERMP	Recalc	ERMP	Recalc	18	0.45	0.63	0.5	0.69	0.75	1.24	21	0.68	0.96	0.72	1.00	1.1	1.27
Receptor	Existing scenario (S1)		Expanded refinery (S2)		Expanded and cumulative sources (S3)																									
	ERMP	Recalc	ERMP	Recalc	ERMP	Recalc																								
18	0.45	0.63	0.5	0.69	0.75	1.24																								
21	0.68	0.96	0.72	1.00	1.1	1.27																								
104	<p data-bbox="250 568 439 592">Chapter 5 of ERMP</p> <p data-bbox="250 603 584 627">Sulfur dioxide and nitrogen dioxide.</p> <p data-bbox="250 638 1061 858">Of the remaining pollutants, SO<sub>2</sub> is the only pollutant with a predicted maximum concentration (~300 µg/m<sup>3</sup>, 1 hour average) approaching the relevant standard (NEPM: 570 µg/m<sup>3</sup>) at a place of residence due to WAPL's emissions. Regional short-term concentrations of SO<sub>2</sub> are dominated by existing and proposed power stations. WAPL would not contribute at all to short term peak levels in or near Collie and would contribute only modestly to longer period averages. There is enough confidence in the emissions estimates and confirmatory monitoring to consider this to be a reliable prediction. We note WAPL's commendable intention to install an SO<sub>2</sub> scrubber on the new coal-fired plant (if built).</p> <p data-bbox="250 869 1043 970">Nitrogen dioxide concentrations are limited by ozone concentration to well less than the NEPM standard. There is uncertainty in the OLM method used to calculate NO<sub>2</sub>. We recommend monitoring of O<sub>3</sub> in addition to NO<sub>x</sub>, SO<sub>2</sub> and particulates at the new site J monitoring station (for a year or two at least to confirm the NO<sub>2</sub> chemistry).</p> <p data-bbox="250 981 965 1005">(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p data-bbox="1099 568 1921 592">The OLM is considered to provide a conservative estimate of NO<sub>2</sub>. Given this and that:</p> <ul data-bbox="1099 603 2040 715" style="list-style-type: none"> <li>• modelling predictions of NO<sub>2</sub> using the OLM in this study and by others for proposals of Collie power stations have all consistently predicted NO<sub>2</sub> levels well below the NEPM standard; and</li> <li>• the NO<sub>2</sub> measurements from Worsley's three ambient monitoring stations for over a year (with another 18 months data to be analysed shortly) indicate levels well below the NEPM standard.</li> </ul>																												
105	<p data-bbox="250 1019 439 1043">Chapter 5 of ERMP</p> <p data-bbox="250 1054 371 1078">Short stacks</p> <p data-bbox="250 1090 1016 1137">WAPL's stacks and vents tend to be short and wake affected. WAPL may wish to consider taking this into account when investigating localised impacts.</p> <p data-bbox="250 1149 965 1173">(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p data-bbox="1099 1019 1167 1043">Noted.</p>																												

Item	Submission	Response
106	<p>Chapter 5 of ERMP Modelling</p> <p>Comments do not affect conclusions above about various pollutants.</p> <p>Summary points are:</p> <ul style="list-style-type: none"> <li>- “anthropogenic heat flux” (from the refinery) incorrectly includes heat lost from stacks and vents modelled in Calpuff. This would result in excess dispersion in the vicinity of the refinery (importance unknown);</li> <li>- use of TAPM to drive Calmet proved problematic, requiring some novel and dubious approaches to modifying the windfields. The final Calmet wind fields contain (on occasions we examined) an anomalous quadrant of lower winds at upper levels (importantly layers 2 to 4) due to combination of barriers and Step 2 re-incorporation of measured winds with vertical extrapolation, and reflecting the relatively high winds predicted by TAPM (see example in wind vector diagram below).</li> <li>- paucity of cloud data is a problem. Net radiation should be explored for surrogate derivation of cloud amount.</li> <li>- there is likely to be a problem with Calmet doubling-up on deepening of the mixing depth, but not enough information is provided to check.</li> </ul> <p>We recommend that Worsley be asked to commit to refinement and, where necessary, correction of the modelling in the course of the forthcoming DoE-coordinated study of Collie air quality, including collaboration on meteorological and pollutant measurements.</p> <p>Model statistics for site T and facility 303 look good. Site FWL shows under-predictions despite the high RHC values. Noting that plumes carrying these pollutants would have been transported in upper layers with wind fields showing anomalous patterns as below, it is hard to know how general the model validation is for other refinery sources with shorter stacks.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>The energy flux from the stacks, estimated through <math>E=\sigma T^4</math> (where <math>\sigma</math> is the Stefan-Boltzman constant and T the temperature in Kelvin), indicates that the total heat flux attributed to the stacks is &lt;1MW compared to the 300 MW released from the refinery as a whole.</p> <p>Refinement and, where necessary update of modelling, will be undertaken in future studies.</p> <p>We consider that the use of 3D models provides benefits over traditional gaussian models for many reasons, notably better simulation of dispersion across wider regions where topographic and land use influences on local dispersion are better accounted for. It is certainly acknowledged however, that there are difficulties in determining how to provide the Calmet model with upper air meteorological data in regions away from radiosonde data (nearest sources to Worsley are Perth and Albany). The method used for the study (use of TAPM data) was that recommended by a consensus of modellers at a workshop hosted by Worsley prior to the preparation of the ERMP.</p> <p>It is accepted that improved methods need to be used. Subsequent modelling has begun to use MM3 to generate meteorological data. Worsley will continue to refine modelling methodology as part of its ongoing Air Emission Impact Assessment.</p>
107	<p>Chapter 5 of ERMP</p> <p>In Table 5.14 (see footnotes) a power law has been used to convert 1-hour PM10 to 24-hour. These averages would be better calculated directly by the model.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	Noted.
108	<p>Chapter 5 of ERMP Health Risk Assessment</p> <p>More work as part of the Collie air study needs to be undertaken to gather all the important emissions information.</p> <p>It is likely that the hazard indices in Figure 5.14 would be significantly boosted by the inclusion of BRDA PM<sub>10</sub>, as previously explained.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	See response to item 103. Worsley has indicated its willingness to participate in any Collie regional study.



Item	Submission	Response																					
109	<p>Chapter 5 of ERMP Air Quality Management Plan</p> <p>This plan has not been reviewed at the time of writing. However the brief summary on page 5-59 indicates the plan contains necessary items of further work (eg estimating emissions from area sources). We assume the plan will be locked in as requirements of approval. We assume the same in relation to proponent commitments on page 5-60. (Department of Environment, Air Quality Division, received 19 August 2005)</p>	Matter to be addressed by the EPA.																					
110	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>Fugitive emissions seem to have been excluded. The following concerns are raised regarding emissions: (Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>The development of the Version 1 emissions inventory is outlined in Volume 1, Chapter 5, Section 2.7.1, and provided in detail in Appendix 9 of the ERMP.</p> <p>Since construction of the Version 1 inventory, a review of particulate emission from residue disposal areas has been undertaken. See response to item 103.</p>																					
111	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>Table 3 Investigation Levels for formaldehyde, toluene and xylene are out of date draft numbers – see the final NEPM on the web and our calculated conversions below:</p> <table border="1" data-bbox="250 676 983 935"> <thead> <tr> <th data-bbox="250 676 568 708">Air Toxic</th> <th data-bbox="568 676 757 708">ppm (NEPM)</th> <th data-bbox="757 676 983 708"><math>\mu\text{g}/\text{m}^3</math> @ STP</th> </tr> </thead> <tbody> <tr> <td data-bbox="250 708 568 740">Benzene - annual</td> <td data-bbox="568 708 757 740">.003</td> <td data-bbox="757 708 983 740">10.5</td> </tr> <tr> <td data-bbox="250 740 568 772">Formaldehyde – 24 hr</td> <td data-bbox="568 740 757 772">.04</td> <td data-bbox="757 740 983 772">53.6</td> </tr> <tr> <td data-bbox="250 772 568 804">Toluene – 24 hr</td> <td data-bbox="568 772 757 804">1</td> <td data-bbox="757 772 983 804">4113</td> </tr> <tr> <td data-bbox="250 804 568 836">Toluene – ann</td> <td data-bbox="568 804 757 836">.1</td> <td data-bbox="757 804 983 836">411</td> </tr> <tr> <td data-bbox="250 836 568 868">Xylene – 24 hr</td> <td data-bbox="568 836 757 868">.25</td> <td data-bbox="757 836 983 868">1185</td> </tr> <tr> <td data-bbox="250 868 568 900">Xylene – ann</td> <td data-bbox="568 868 757 900">.2</td> <td data-bbox="757 868 983 900">948</td> </tr> </tbody> </table> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	Air Toxic	ppm (NEPM)	$\mu\text{g}/\text{m}^3$ @ STP	Benzene - annual	.003	10.5	Formaldehyde – 24 hr	.04	53.6	Toluene – 24 hr	1	4113	Toluene – ann	.1	411	Xylene – 24 hr	.25	1185	Xylene – ann	.2	948	Noted regarding outdated NEPM numbers.
Air Toxic	ppm (NEPM)	$\mu\text{g}/\text{m}^3$ @ STP																					
Benzene - annual	.003	10.5																					
Formaldehyde – 24 hr	.04	53.6																					
Toluene – 24 hr	1	4113																					
Toluene – ann	.1	411																					
Xylene – 24 hr	.25	1185																					
Xylene – ann	.2	948																					
112	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>page 12 excerpt:</p> <p>Plume dispersion modelling has undergone significant refinement in recent years. Steady state Gaussian plume air dispersion models such as AUSPLUME and the USEPA's ISC3, which formed the basis of air dispersion assessment for many years, are now being replaced by a generation of fully three-dimensional models, most notably CSIRO's TAPM and the USEPA's CALMET and CALPUFF.</p> <p>This is not correct – the USEPA has specified Aermom as its replacement for ISC3. (not a major issue here) (Department of Environment, Air Quality Division, received 19 August 2005)</p>	Agreed, CALPUFF is a regulatory US-EPA model and AERMOD is proposed as a replacement to ISC3. TAPM is not a regulatory model. However, it is accepted by a number of state regulators in Australia.																					
113	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>Refers to specific issues relating to modelling methodology made by AQD. (Department of Environment, Air Quality Division, received 19 August 2005)</p>	Noted. Comments on issue raised are made throughout this report.																					

Item	Submission	Response
114	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>Table 6: wake effects are significant and contribute to ground level impacts. The new calciner has a low stack proposed. The proposed RTO stack is 40 metres – will that be wake affected? See Appendix A comments and recommendation on stack heights (potential occupational health question).</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Wake effects for emissions from both of the above-mentioned sources were included in the modelling.</p>
115	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>RTO reliability may be a key issue. We understand the current RTO has not been reliable. Emissions when the RTO is down have not been considered in modelling. Consideration must be given to odour from fugitive sources.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Reliability problems relate to the operability of the liquor burner and not the RTO emission control system. The RTO is performing according to specifications. The liquor burner goes into shutdown should the RTO not function. Therefore there is no operating scenario whereby the liquor burner is running without the emission control system operating.</p> <p>Also see response to items 99 and 110.</p>
116	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>Section 11. Predicted concentrations.</p> <p>Pollutants of potential interest re impact at residences as a consequence of WAPL's emissions are SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and odour.</p> <p>Maximum 1-hour SO<sub>2</sub> concentrations for a broad grid including Collie township and residences east of power stations show essentially no contribution to the maxima from WAPL.</p> <p>Site J looks like a good location both for WAPL and power station impacts. EPA should recommend the need for this station to be installed and expertly maintained for a period of at least 3 and preferably 5 years, measuring SO<sub>2</sub>, NO<sub>x</sub>, Ozone, PM<sub>10</sub> and meteorology (to be further discussed with DoE re what parameters should be monitored – e.g. solar and net radiation, properly installed). NO<sub>x</sub> and O<sub>3</sub> are included because, even though predicted NO<sub>2</sub> at residences is less than half the NEPM, there are uncertainties about the OLM method used.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Matter regarding site J monitoring station to be addressed by the EPA.</p>
117	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>PM<sub>10</sub> modelling for WAPL is for refinery sources only, ignoring the BRDAs.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>See response to item 103.</p>
118	<p>Appendix 9 of the ERMP prepared by Environmental Alliances and PAE, April 2005</p> <p>Odour modelling results show marginal exceedance of WAPLs odour criterion at residence(s). Matters to be resolved:</p> <ul style="list-style-type: none"> <li>- is the odour criterion adequately protective (having been derived as per the recently rescinded odour guideline);</li> <li>- how important are the neglected odour emissions from fugitive sources.</li> </ul> <p>The consultant applied a power law to the Calpuff results to derive 3 minute values – this would be more valid than allowing Calpuff (or Ausplume) to do its internal modification of <math>\sigma_y</math> only.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>See comments in response to items 99 and 101.</p>

Item	Submission	Response
119	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>Dispersion modelling needs to be tested for sensitivity to refinery heat flux.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Modelling methodology has been developed in consultation undertaken during the Air Emissions Impact Assessment program, and will continue to be refined.</p>
120	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>page 13 – see discussion of wind data assimilation using two met stations situated well apart. Noting the subsequent finding that TAPM overestimates wind speed at a third met station, it is obvious that wind data assimilation would have introduced odd bulls-eye effects in the windfield, notably for periods of light to moderate measured winds. The consultant confirmed this.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Noted.</p>
121	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>page 18 excerpt:</p> <p>The average predicted wind speed is 83% and 56% higher than observed with default and modified land-use respectively. Bearing in mind the potential sheltering at the Collie East monitoring station, the wind speed is generally predicted adequately for both land use simulations (Table 3-3).</p> <p>That is a very optimistic reading of the results.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Noted.</p>
122	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>The derivation of cloud data needs to be improved. Use of a net radiometer would be beneficial.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>A net radiometer will be installed at monitoring Site J.</p>
123	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>The integration of TAPM and Calmet needs to be improved and modeling uncertainty checked. Perhaps using an alternative meteorological model like MM5 can be used?</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Modelling methodology was discussed and developed during modelling workshops as part of the Air Emissions Impact Assessment program.</p> <p>MM5 is being used with subsequent modelling being undertaken at the refinery. Also the recent commissioning of an anemometer at 45 m above ground (light tower) at the refinery should provide good quality, representative wind data for this level. The installation of a net radiometer at Site J should assist heat flux estimates (in lieu of continuous, local cloud cover data).</p>
124	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>Table 3-6 is unusable. All such results need to be graphical.</p> <p>page 36 – we have no way of knowing if the choice of buoyancy flux is correct, but the argument seems reasonable.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	<p>Noted.</p>

Item	Submission	Response
125	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>Table 4.3 – other (Collie) source emissions need review.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	Noted.
126	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>Model statistics for site T and facility 303 look good. Site FWL shows under-predictions despite the RHC values.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	Noted.
127	<p>Comments on Worsley Air Dispersion Modelling Verification Technical Report, March 2005, Environmental Alliances and PAE, March 2005</p> <p>Short stack emission need to be refined in subsequent emission inventories.</p> <p>(Department of Environment, Air Quality Division, received 19 August 2005)</p>	Refinery emissions inventory and sources, dispersion modelling methodology and health risk assessment within and surrounding the refinery will continue to be updated as key aspects of the refinery Air Emissions Impact Assessment.

#### 4.2.7 Noise

Item	Submission	Response
128	<p>Refinery</p> <p>The original work on the refinery indicates that tonality can exist (at the measurement locations) in the direction of the most critical residence, however the report states that there are no intrusive characteristics. Therefore, more evidence is required with regards to noise at the Ballingal property being either tonal or non-tonal.</p> <p>(Lloyds Acoustics for DoE, 13 July 2005)</p>	<p>The total noise emission at the Ballingal premise is 33.7 dB(A) comprising of 32 dB(A) due to the overland conveyor and 28.8 dB(A) due to the expanded refinery. Hence the majority of the noise at the Ballingal premise is primarily due to noise emissions from the overland conveyor and not the refinery. The noise emissions from the refinery are some 6 dB below the night-time assigned noise levels under the <i>Environmental Protection (Noise) Regulations 1997</i>.</p>
129	<p>Rail</p> <p>Analysis of the SVT information and assessment against EIA No.14, highlights that noise may be of an impact between Worsley Siding to Brunswick Junction and Brunswick to Bunbury during the night-time. Further information is required to determine the extent of the impact.</p> <p>Some comment regarding maximum noise levels and number of events (particularly during the night-time) should be provided.</p> <p>(Lloyds Acoustics for DoE, 13 July 2005)</p>	<p>Although it is also acknowledged that rail noise is exempt from noise limits prescribed under the <i>Environmental Protection (Noise) Regulations 1997</i>, the EPA has indicated that noise associated with a cumulative increase in rail freight, in particular along the Pinjarra to Bunbury section of the Perth - Bunbury, railway may potentially result in loss of amenity at some residences. Any potential impacts are also acknowledged by the EPA as being as a result of overall cumulative volume of rail traffic and issues of rail noise involve a number of entities, in particular rail service providers and local and regional planning authorities.</p> <p>It is understood that the EPA will be commissioning an independent review of potential impacts associated with rail traffic, and that this review will encompass all rail movements. Worsley is willing to contribute the necessary and relevant information required for the EPA to undertake these investigations.</p> <p>The number of train movements is expected to be evenly distributed throughout the day and night.</p>

Item	Submission	Response
130	<p>Corridor</p> <p>Exceedances against the night-time assigned noise levels of the <i>Environmental Protection (Noise) Regulations 1997</i> are noted for both the existing and future conveyor systems. It is stated that compliance is only required with the State Agreement. Therefore, the following issues are raised:</p> <p>Does the State Agreement take precedence?</p> <p>Does the State Agreement get periodically reviewed?</p> <p>Does the State Agreement apply to future conveyors?</p> <p>What are the actual noise levels at houses (only reported as being above 35 dB(A))?</p> <p>Are the existing or future conveyors tonal?</p> <p>Is it practicable to achieve 35 dB(A) (with tonal penalties if required) or what is the practicable noise level that can be achieved?</p> <p>(Lloyds Acoustics for DoE, 13 July 2005)</p>	<p>The State Agreement exempts Worsley from the <i>Environmental Protection (Noise) Regulations 1997</i> and establishes noise limits for operation of the conveyor as described in the ERMP.</p> <p>The Clauses of the State Agreement 12C.(1) through 12C.(6) that establish noise limits and management to be applied to control noise do not require periodic review of these conditions.</p> <p>The State Agreement also constrains provisions for extension of conveyor systems and required that any extension of the conveyor will ensure compliance with noise limits prescribed by the State Agreement.</p> <p>This work has not been done, as noise emissions from the conveyors satisfy the State Agreement.</p> <p>The existing conveyor is cable belt type, and hence it is tonal in noise characteristics. Future conveyors will be conventional idler/belt type and are likely to have noise levels some 25-30 dB quieter than the existing cable belt. However, it also has the potential to be tonal in characteristic when a receiver is relatively close to the belt. However, the level of the tonality will depend on what speed the belt is operated, the size of the idler, and how close the receiver is to the conveyor belt and the ambient background noise for the receiver location. All of these issues will need to be resolved during detailed design of the conveyor belt system to ensure that noise emissions at potential receivers are not tonal in characteristics.</p> <p>No, the current cable belt conveyor would not be able to achieve this, hence this is why a State Agreement on noise was sort and obtained.</p>
131	<p>Mine</p> <p>There is a conflict between "daytime" operating hours of the Regulations and mine "daytime" activities.</p> <p>It is assumed that there are no tonal characteristics. Is there evidence to support this?</p> <p>All trucks have been placed in pits in the noise model. Some trucks will be on-route and this should be taken into consideration.</p> <p>Figure 3.16 of the Strategen report (Volume 2) differs from those of SVT.</p> <p>Are exceedances / noise complaints reported to the EMLG and/or public?</p> <p>(Lloyds Acoustics for DoE, 13 July 2005)</p>	<p>Our experience with truck noise measurements on site is that at distances typically beyond 500 to 1000 m, due to the transient nature of mobile equipment (i.e. engine speed and vehicle speed is constantly changing, along with varying terrain that the vehicles are working within), a 1/3rd octave band Leq measurement over a long duration (i.e. greater than 15 minutes) is usually broad band in characteristic and strong tones do not develop. However, if tonality does arise due to the close proximity of noise sensitive premises to mining operations then Worsley will take this into account as part of its mine planning operations. This may mean further restrictions on when areas can be mined, and how they are mined (i.e. the number of mobile equipment in use, etc.)</p> <p>Due to the complexity and the large number of pits that could be mined it was not considered feasible to incorporate this in the modelling at this stage. When more definitive details of possible haul routes and pit layouts are available, then this form of modelling will be taken on board to ensure compliance is achieved.</p> <p>Worsley reports environmental performance across all operational areas as required by the State Agreement and environmental licence conditions. This includes reporting exceedances, complaints and reports received in relation to noise arising from its operations.</p> <p>Worsley's reporting of performance is undertaken in two forms; within the Annual Environmental Report and the Health Safety, Environment and Community Report. Both of these reports are publicly available.</p> <p>The Annual Environmental Report is made available to the EMLG for review prior to finalisation and provides opportunity for the EMLG to provide feedback on Worsley's environmental performance. If appropriate, the EMLG may also advise the Minister for the Environment through the Minister for State Development on Worsley's compliance with conditions.</p> <p>An important consideration is that Worsley are obliged to comply with <i>Environmental Protection (Noise) Regulations 1997</i>.</p>

Item	Submission	Response
132	<p>Commitment 14. Noise</p> <p>While having an interest in the potential impacts of proposal noise on user amenity and other values, CALM does not believe it would be appropriate for it to be a key agency directly involved in audit of Commitment 14 – Noise.</p> <p>(CALM, received 3 August 2005)</p>	<p>Noted. This is a matter to be addressed by the EPA.</p>
133	<p>VOLUME 1, Chapter 1, Figure 1.15, p 1-43of ERMP</p> <p>An approximate doubling of train movement on the Refinery to Collie and Refinery to Bunbury Port lines is significant. The noise and spillage risks would increase. The spillage risk particularly relates to impacts on the Brunswick River (the rail-line follows the Brunswick in sharply sloping terrain). The noise risk particularly relates to the Greater Bunbury urban area, particularly residential areas abutting the Port of Bunbury. The port environs are the most contentious due to the additional noise from shunting and idling activities.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. Any changes in the risk profile of operations from an expanded project will be fully taken into account in Worsley emergency response planning and procedures. An assessment of the impact of additional rail noise due to the expansion has been presented in the ERMP. It is also understood that the EPA is commissioning an independent evaluation of train noise along rail line that takes into account potential increases in rail freight due to increases in Alcoa World Alumina's operations, Worsley's proposed expansion and other rail users.</p>
134	<p>What will be the cumulative noise impact of increased rail traffic due to all of the proposed expansions?</p> <p>(Shire of Collie, received 10 August 2005)</p>	<p>Changes in traffic (both road and rail) are described in Volume 1, Chapter 5, Section 6 of the ERMP. In respect of increased rail traffic, the ERMP shows that train movements will increase due to an increase in supply of caustic and coal to the refinery, and due to an increase in raiiling alumina from the refinery to the Bunbury Port. Overall train movements on the Worsley – Brunswick – Bunbury line will increase by eight movements per day; and movements on the Worsley – Collie line will increase by two movements per day.</p> <p>SVT Engineering has undertaken modelling to estimate the likely increase in noise due to the increase in rail freight. This modelling has been undertaken based on monitoring of actual train passby noise levels. Modelling by SVT (presented in Volume 1, Chapter 5, Section 3 of the ERMP) shows that noise levels are expected to increase as follows:</p> <ul style="list-style-type: none"> <li>2.1 to 2.2 dB(A) along the Worsley to Brunswick line</li> <li>2.5 to 3 dB(A) along the Worsley to Collie line</li> <li>1.5 dB(A) along the Brunswick to Bunbury line</li> </ul> <p>Modelling undertaken by SVT takes into account only noise due to increases in rail movements as a result of the proposed expansion. Some cumulative increase in rail noise may be expected along the Brunswick to Bunbury line, due to extra rail traffic associated with Alcoa's expansion at Pinjarra Refinery, and the proposed expansion at the Wagerup Refinery.</p> <p>Worsley has been advised by the EPA that an independent study is to be undertaken and will address changes in cumulative rail noise due to the Pinjarra, Wagerup, Worsley alumina refinery expansions, along with other increases in rail traffic along the Pinjarra to Bunbury line. Worsley is willing to contribute the necessary and relevant information in order that this study be undertaken.</p> <p>It is important to note that the noise arising from railways is exempt from the requirements of the <i>Environmental Protection (Noise) Regulations 1997</i>.</p>

#### 4.2.8 Aboriginal heritage and culture

Item	Submission	Response
135	<p>In terms of Aboriginal Heritage issues the Department of Indigenous Affairs has been involved in the conduct of recent heritage surveys and the formulation of a predictive model for the location of archaeological sites within the project area. The Department has provided comment on the associated reports direct to the author's and a copy has been lodged with the Departmental Heritage Survey Report collection.</p> <p>To date the approach adopted by Worsley in the consideration of Aboriginal heritage issues has been adequate. Provided that Worsley continue to satisfy commitments made in regarding to the recording and protection of heritage sites Aboriginal heritage issues have been appropriately dealt with.</p> <p>Worsley is also fully aware of their obligations under the <i>Aboriginal Heritage Act 1972</i>. (Department of Indigenous Affairs, 14 June 2005)</p>	Noted.

#### 4.2.9 Traffic (road and rail)

Item	Submission	Response
136	<p>Issues previously raised by Council with respect to the Worsley ERMP include:-</p> <ul style="list-style-type: none"> <li>• Impact of additional train movements and longer trains on residents in Brunswick and Roelands.</li> </ul> <p>(Shire of Harvey, received 3 August 2005)</p>	See response to item 134.
137	<p>Issues previously raised by Council with respect to the Worsley ERMP include:-</p> <ul style="list-style-type: none"> <li>• Infrastructure improvement issues with respect to road networks, including Coalfields Highway and Mornington Road.</li> </ul> <p>(Shire of Harvey, received 3 August 2005)</p>	<p>Worsley considers that any potential impacts associated with increased road traffic are most likely to be apparent during the project construction period when materials are being delivered to the site and the construction workforce is at its peak. Worsley has committed to the development of a construction management plan to be implemented during the project construction phase. Management of road traffic will be a significant aspect of this plan and will include the implementation of existing requirements that schedule truck arrivals at the refinery to avoid peak passenger vehicle movement periods along the Coalfields Highway, and potentially providing buses to reduce the number of construction related cars using Coalfields Highway.</p> <p>Worsley will continue its existing policy of requiring that contractor heavy vehicles do not use Mornington Road to access the refinery.</p> <p>Worsley is a participant in local industry bodies that are involved in assessing local infrastructure status and needs, including assessment of increasing road traffic in the region. During both the scoping of ERMP studies and preparation of the ERMP Worsley has provided briefings to these bodies in order that requirements of, and likely impacts of the proposed expansion are taken into account. Worsley will maintain active participation with local industry bodies throughout the project construction and commissioning phases.</p>
138	<p>What assistance will Worsley provide to the Shire of Collie to improve/maintain roads to meet the needs of heavier road traffic?</p> <p>(Shire of Collie, received 10 August 2005)</p>	See response to item 137.

#### 4.2.10 Bauxite transport

Item	Submission	Response
139	<p>A particular concern is the inclusion in the ERMP of proposed conveyor alignments under "Proposed Bauxite Transport Routes". The consideration of potential impacts is inadequate and no alternative route analyses have been undertaken. CALM recommends that the conveyor alignments should not be approved as part of this ERMP process and instead should be considered in a separate and specific environmental approval process, after detailed analysis of route options and potential environmental impacts.</p> <p>(CALM, received 3 August 2005)</p>	<p>See general response provided in section 3. Worsley considers that the extension of bauxite transport systems can be handled by the same approach.</p>
140	<p>The proposed Bauxite Transport Routes have significant potential for impacts on biodiversity and other values because of the potential for major changes to access, disease risk, visual amenity, noise and overall management of the CALM-managed estate. These risks and impacts should have been a significant focus of the ERMP and will need to be considered at a more detailed level as part of a staged implementation approvals approach.</p> <p>It is noted that the conveyor alignments are indicative only, that minimal studies have been undertaken in relation to impacts and that no information is provided in relation to alternative alignment analysis. The ERMP states that the designs will be part of a mine planning process and reviewed by the EMLG (Executive Summary pg 24). The process of evaluating conveyor alignments is a significant issue for stakeholders. Issues relate to Phytophthora dieback risk, biodiversity impacts, visual impacts and CALM's increased cost of fire management in relation to protection of infrastructure. In the absence of appropriate assessment the Department considers that the statement that the corridor will not significantly detract from visual amenity because of existing cleared corridors (Executive Summary pg 30) is of dubious value.</p> <p>Alternative alignment analysis should require the direct involvement of CALM, the community, and the approval of the Minister for the Environment, and not just be "reviewed by the Environmental Management Liaison Group" (page 24).</p> <p>(CALM, received 3 August 2005)</p>	<p>See general response provided in section 3 and item 139.</p>
141	<p>Given the considerable lead time before conveyors will be required, there may be changes in conveyor (or other transport) technology that may allow for better environmental outcomes compared to existing conveyor technology. Planning for bauxite transport should be structured to accommodate best environmental practice transport technology of the time.</p> <p>(CALM, received 3 August 2005)</p>	<p>Noted.</p>



Item	Submission	Response
142	<p>Bauxite Transport Corridor Commitments 12 &amp; 13. Relevant environmental factors</p> <ul style="list-style-type: none"> <li>• The proponent should be required to develop a conveyor alignment assessment process to examine alignment options to the requirements of the Minister for the Environment on CALM's advice. The process should require:</li> <li>• an agreed scope and methodology for alternative alignment assessment;</li> <li>• an evaluation of alternative alignments subject to public review;</li> <li>• a management plan for conveyor construction and management.</li> <li>• The alignment evaluation should address risks and impacts to biodiversity, landscape, user amenity and water quality values.</li> <li>• The proponent should meet the full cost of measures necessary to protect the infrastructure from fire. This will need to include the cost of prescribed burning over and above normal forest prescribed burning requirements.</li> <li>• The construction specifications for any linear infrastructure must accommodate the need for access across the alignments for land management purposes, including fire management.</li> <li>• As conveyor technology may improve over time in terms of its capacity to minimise environmental impacts, the planning framework and timelines for conveyors should provide the flexibility to adopt new transport technology that facilitates environmental outcomes.</li> </ul> <p>(CALM, received 3 August 2005)</p>	Matter to be addressed by the EPA.

#### 4.2.11 Risk assessment

Item	Submission	Response
143	<p>VOLUME 1, Chapter 2, Section 5 (from p2-30) of ERMP</p> <p>Is somewhat simplistic, by introducing the concept of Risk Assessment, without actually giving the conclusion/detail of that risk assessment - eg as per Table 2.15. This has been completed by the Department for the existing Worsley refinery operations, in connection with the Welker review, and it is suggested that a risk assessment is carried out for "refinery" and "mining" (ie two assessments). Table 2.14 should clarify the column heading "Social Environment" by inserting the word human beforehand, to separate it from the natural environment. Section 5 should probably have been left out altogether, and the EPA services unit do the assessment.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Noted.

#### 4.2.12 Emergency preparedness and response

Item	Submission	Response
144	<p>The emergency response aspect does not appear to be addressed with the preparation of this ERMP. From a FESA perspective this aspect attracts the following questions:</p> <ol style="list-style-type: none"> <li>1. Can the proponent advise on the additional quantities of hazardous materials that will be required as a result of expansion of this project.</li> <li>2. Will the additional hazardous materials make up the total hazardous materials stored on-site require the facility to be reclassified as a Major Hazard Facility</li> <li>3. How will these additional hazardous materials be transported on-site and what will be the additional risks conferred because of this.</li> <li>4. Will the proponent review its emergency response plan for the whole expanded operation including the additional hazardous materials?</li> <li>5. Is there an emergency response team on-site?</li> <li>6. If so, is the emergency response team equipped and apply procedures that are compatible with FESA Fire Services procedures.</li> </ol> <p>(Fire and Emergency Services, 14 June 2005)</p>	<ol style="list-style-type: none"> <li>1. Operation of the alumina refinery requires significant quantities of hazardous materials. In terms of quantities, the predominant hazardous materials transported to and utilised on-site include caustic, lime, coal, natural gas and acids. Other hazardous materials used at the refinery include those used for equipment cleaning and servicing and laboratory reagents.</li> </ol> <p>Total quantities of the predominant hazardous materials required for the proposed expansion are given in Figure 1.14 of the ERMP. The indicative additional quantities of these materials required for the expansion are as follows: caustic increase by 15%; lime increase by 25%; coal increase by 60%; natural gas increase by 20%; and acids increase by 15%.</p> <p>It should be noted that the ERMP represents an expansion case using coal as the energy source.</p> <ol style="list-style-type: none"> <li>2. The Worsley Refinery is a major industrial site involving the transport, storage and usage of large quantities of hazardous materials. As such the refinery is required to be licensed for the storage and handling of hazardous materials in accordance with <i>Dangerous Goods Regulations 1999</i>. Following the expansion, licensing under the <i>Dangerous Goods Regulations 1999</i> will require updating to account for any additional storage of hazardous materials on-site.</li> <li>3. Transport of raw materials is detailed in Section 4.3.8 of the ERMP and indicates that additional quantities of caustic and coal will be transported by rail. Additional quantities of lime are likely to be transported by road, together with increases in road transport of acids and other reagents. Natural gas is supplied to the refinery via an existing spur from the Dampier to Bunbury Natural Gas Pipeline.</li> </ol> <p>Worsley's existing emergency response plan and cooperative arrangements with emergency services authorities will continue following the expansion. The proportional increases in transport of hazardous materials to the refinery does not create additional transport risk for the operation. However, the increased transport frequency may be considered to alter the likelihood of associated risks. Update of the emergency response plans will be undertaken using an Enterprise Wide Risk Management approach, as is required by corporate policy.</p> <ol style="list-style-type: none"> <li>4. The refinery emergency response plan is continually updated and amended to take into account changes implemented at the refinery. As required, working arrangements with emergency service agencies are periodically updated following any change in the project risk profile. The emergency response plan will be updated as required following the expansion.</li> <li>5. Worsley maintains fully trained emergency response personnel and teams on site. A memorandum of understanding exists between Worsley and FESA that sets out response procedures and responsibilities of Worsley's emergency response team in the event of an emergency.</li> <li>6. Worsley emergency response teams are fully equipped and trained by FESA personnel. Emergency response teams follow protocols that are established by FESA.</li> </ol>
145	<p>VOLUME 1, Chapter 1, Figure 1.15, p 1-43 of ERMP</p> <p>An approximate doubling of train movement on the Refinery to Collie and Refinery to Bunbury Port lines is significant. The noise and spillage risks would increase. The spillage risk particularly relates to impacts on the Brunswick River (the rail-line follows the Brunswick in sharply sloping terrain). The noise risk particularly relates to the Greater Bunbury urban area, particularly residential areas abutting the Port of Bunbury. The port environs are the most contentious due to the additional noise from shunting and idling activities.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. Any changes in the risk profile of operations from an expanded project will be fully taken into account in Worsley emergency response planning and procedures. An assessment of the impact of additional rail noise due to the expansion has been presented in the ERMP. It is also understood that the EPA is commissioning an independent evaluation of train noise along rail line that takes into account potential increases in rail freight due to increases in Alcoa World Alumina's operations, Worsley's proposed expansion and other rail users.</p>

Item	Submission	Response
146	<p>Incident reporting and management should include:</p> <ul style="list-style-type: none"> <li>reporting all spills to the Water Corporation and DoE; and</li> <li>significant rainfall events need to be closely monitored with a specific focus on drainage and runoff; and</li> <li>all incidents with potential water quality impacts to be reported.</li> </ul> <p>(Water Corporation, received 10 August 2005)</p>	<p>Environmental licences issued for the refinery and mine site contain relevant conditions for reporting of incidents. Such incidents are also reported in the Annual Environmental Report.</p>
147	<p>Sufficient notification of exploration activities, including blasting, should be given to the Water Corporation staff working in that area.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Noted. Details of such control mechanisms to be developed in working arrangement for operations in public water supply areas and in consultation with key stakeholders.</p>

#### 4.2.13 Closure planning

Item	Submission	Response
148	<p>Refinery - The ERMP identifies the requirements of the Environmental Management Liaison Group (EMLG) in relation to 'guiding principles' for closure of the refinery site (Vol 1 pg 2-34). It includes the principle (pg 2-35) that there should be "...no ongoing financial liability to the State in the way of increased management costs to State agencies." However, the proponent's objectives (pg 2-36) are to "minimise long term liabilities". The proponent's objectives should align with the EMLG guiding principles and meet all ongoing financial liabilities unless otherwise determined by the State.</p> <p>(CALM, received 3 August 2005)</p>	<p>Noted.</p>
149	<p>Minesite – closure objectives are discussed in very general terms in Vol 1 (section 6.3.3 pg 2-37). The proponent should commit to, and be required to meet, completion criteria that provide for no ongoing management liability to the State beyond the normal management costs of un-mined State forest. This should include a requirement for the proponent to ensure that, in relation to fire management, the rehabilitated bauxite mine be successfully integrated into the management of the surrounding native forest with no extraordinary costs to the State. Handback of rehabilitation should not be considered until integration has been achieved across strategic areas in the order of 2000 to 5000 hectares.</p> <p>(CALM, received 3 August 2005)</p>	<p>Matter to be addressed by the EPA.</p>
150	<p>Commitment 3. Closure</p> <p>This commitment should be on the advice of CALM as both the refinery and the majority of mining in forested areas is within State forest.</p> <p>(CALM, received 3 August 2005)</p>	<p>Matter to be addressed by the EPA.</p>

#### 4.2.14 Rehabilitation

Item	Submission	Response
151	<p>The Department believes that the proponent should be required to explain the likely effectiveness of planned rehabilitation operations on the basis of its past performance in the Mt Saddleback operations. The document produced by URS (2004) is a summation of most of the background information needed to make such an assessment of past operations. Close examination of this document indicates that it does not currently contain sufficient analyses of past operations to demonstrate that flora establishment in past rehabilitation is “developing on a trajectory towards the floristics, structure and function displayed by the vegetation of the surrounding forest and to identify any discrepancies that may prevent or delay this desired result.” (URS 2004, pg 4-3). It is understood that these analyses are currently being conducted by researchers at The University of Western Australia, but are not yet available. Therefore the Department is not currently in a position to judge whether the proposed Rehabilitation Plan will achieve the targets set.</p> <p>(CALM, received 3 August 2005)</p>	<p>Noted. The University of Western Australia is continuing these analyses, as mentioned in the submission.</p>
152	<p>Phytophthora Dieback - The proponent has not released any audit of their current Forest Diseases Management plan. Operations at Mt Saddleback may be very different with regard to the impact of Phytophthora cinnamomi, and the proponent may not be in a position to use the past Forest Diseases Management plan as justification for the proposed expansion management plan.</p> <p>(CALM, received 3 August 2005)</p>	<p>As with all management plans and procedures, the Forest Disease Management Plan will be continually reviewed and updated as required. Performance is reported annually in the Annual Environmental Report.</p>
153	<p>An examination of the return of fauna to minesite rehabilitation suggests that 90 of the 104 vertebrate species known to occur in jarrah forest in the Saddleback Timber Reserve have been found in rehabilitated areas. Whilst this is encouraging, CALM believes that this presentation of data could be misinterpreted. For example, the ERMP suggests that three of the mammal species, the Mardo, Western Pygmy-possum and the Honey Possum are commonly recorded in the rehabilitation. However, no data are presented to demonstrate if the return of these species is a stage in a successional process, and if they drop out of rehabilitation at some point. More importantly, the data do not provide information on the residency of these species. Recent research at Murdoch University has demonstrated that species like the Mardo can be highly transient.</p> <p>(CALM, received 3 August 2005)</p>	<p>Worsley anticipate that the occurrence of pygmy possums, honey possums and mardos will change as rehabilitation matures, and that the representation of these species will be similar in rehabilitation as in surrounding forest.</p>

Item	Submission	Response
154	<p>Commitment 7. Rehabilitation</p> <ul style="list-style-type: none"> <li>• Completion criteria should include a requirement to establish measurable goals as identified in URS (2004). Completion criteria should be to the requirements of the Minister for the Environment on the advice of CALM and DoE. The proponent should be required to meet completion criteria that provides for no ongoing management liability to the State beyond the normal management costs of unmined State forest.</li> <li>• It is noted that direct return topsoil results in a species diversity increase of approximately 30%. Whilst URS (2004) identifies that Worsley are achieving a high percentage of direct return topsoil in the rehabilitation, current technology allows for complete coverage of direct return topsoil using direct return surrogates (sieving and airstream separation). It is recommended that a target of 100% of rehabilitation treated with direct return topsoil should be adopted without delay.</li> <li>• A Phytophthora dieback and weed management strategy audit should be undertaken and repeated on a periodic basis. This should include all aspects of research, monitoring and management.</li> <li>• The proponent should monitor and report the number of resident fauna species that breed within rehabilitated sites in relation to unmined forest to help demonstrate the long-term impacts of mining on fauna.</li> <li>• The proponent should further investigate the salvage and transplanting of grass trees in rehabilitation with the objective of implementing transplantation of grass trees on a large scale.</li> <li>• Rehabilitation sustainability - URS (2004) (pg ES-2 para 4) identified a need for further research in relation to the capacity of the rehabilitation to access deep stored water. The proponent should instigate and fund a research program as a priority to determine the ability for the rehabilitated forest to develop a root architecture that will have the capacity to access water stored deep in the soil profile.</li> <li>• Fire protection for rehabilitation - The proponent should be required to meet the additional costs in relation to CALM's prescribed burning programs in regards to protection of the forest and rehabilitation. The proponent will need to cover costs over and above normal prescribed burning costs that would occur in the absence of a mining operation.</li> <li>• Mining, strategic access and rehabilitation plans must sequence these operations to accommodate the integration of significant contiguous areas of rehabilitation (2000 to 5000+ ha) back into surrounding forest for the purpose of fire management as soon as possible after mining has been completed.</li> </ul> <p>(CALM, received 3 August 2005)</p>	<p>Worsley has committed to preparing a rehabilitation plan with advice from CALM and the EMLG. Commitment (No. 7) presented in the ERMP provides the content and main emphasis of the rehabilitation plan. Details of specific aspects such as topsoil usage, progress of development of completion criteria, system audits, etc are proposed to be developed on advice from the above groups as the plan is developed.</p> <p>The CALM/Worsley working arrangements provide a parallel mechanism for addressing many of the items raised by this submission.</p>
155	<p>It is important that the proponents commit to long term monitoring of the effects of the mining and remediation measures if required. Rehabilitation, monitoring and remediation will be required well beyond the life of the mine and this must be recognised in the mine closure plan.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	<p>Noted. Closure monitoring is recognised as a key issue for the development of project closure plans.</p>

Item	Submission	Response
156	<p>Research in the higher rainfall areas in Wungong Catchment show that Alcoa's mining rehabilitation is using more water than the regrowth forest it replaced. There is uncertainty if this pattern will continue, or how this translates to the lower rainfall areas that Worsley want to mine, but it raises concerns about Worsley's rehabilitation. The Worsley proposal document focuses on water quality, but not much on water quantity.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>Worsley's rehabilitation program has to date focussed on restoring values compatible with forest surrounding existing mining operations located at Saddleback. As rehabilitation occurs in areas having different requirements, the rehabilitation prescription and management process will be altered accordingly and in consultation with key stakeholders including the Water Corporation, DoE, CALM and the EMLG. The adaptive rehabilitation program is demonstrated by Worsley's development of rehabilitation prescription suitable for agricultural land disturbed by mining operations.</p>
157	<p>Page 3-42 of Volume 1 in the list of issues to be covered by rehabilitation plan: This needs to include water criteria for mining operations and rehabilitation. Monitoring of streams and bores is required downstream of the refinery and mining areas with sites established under the guidance of DoE. Existing hydrological monitoring should be used and new monitoring established where required. Some relevant stream gauging has been discontinued and Worsley will need to fund its refurbishment and ongoing operation with possible financial assistance from DoE. This should include groundwater bores drilled to bedrock at approx 1km intervals to measure water table and salinity (including seasonal response) in the drinking water catchments before, during, and after mining. Monitoring should also include measurement of stream flow and quality (including salinity and turbidity) at least at:</p> <ul style="list-style-type: none"> <li>• S616002 – Mundaring Catchment, Darkin River Pine Plantation (open from 1968);</li> <li>• S616039 – Canning Catchment, Millars Road, (open 1973 – 1999); and</li> <li>• S614035 – Serpentine Catchment, River Road, (open 1982 – 1999).</li> </ul> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 156 regarding Worsley's rehabilitation program.</p> <p>Monitoring bores have been in place around and downstream of the refinery and have been operational since refining operations began. These bores are established under requirements of the Agreement Act and results are reported annually in the AER. As new facilities, in particular residue disposal areas are established within the refinery lease area, new bores are commissioned. Similarly, monitoring of water quality and flow downstream in the Augustus River has been undertaken since refinery operations began. At the Boddington bauxite mine, regional monitoring of both groundwater and surface water is undertaken. Results are reported annual in the AER. Both refinery and mining area water monitoring programs, to the requirements of the DoE will continue for expanded operations.</p>
158	<p>Page 1-30 of Volume 1:</p> <p>The report on rehabilitation which formed part of the proposal did not give much consideration to the fact that mining would be in a drinking water catchment, nor the lessons learned from the impact of Alcoa's mining on water quantity. Hence some alterations to mining rehabilitation may now be required. This is a fundamental change to what Worsley have done before, and rehabilitation objectives should include objectives for water quality and quantity that maintain or improve the status quo.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 156.</p>
159	<p>Commitment 5 on rehabilitation should include a water criteria.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 156.</p>
160	<p>Rehabilitation should be at appropriate density and have ongoing management (if required) to ensure it has the same or less evapo-transpiration than the forest it replaced.</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 156.</p>
161	<p>Ideally, ongoing management should be designed to help move rehabilitation towards a mature forest (not just the dense regrowth forest that it replaces).</p> <p>(Water Corporation, received 10 August 2005)</p>	<p>See response to item 156.</p>

Item	Submission	Response
162	<p>Consideration should be given to funding research and management of remnant Eucalyptus Wandoo which is in decline and within the mining lease. The Wandoo Recovery Group should be consulted on this matter (chaired by Department of Conservation and Land Management).</p> <p>(Water Corporation, received 10 August 2005)</p>	Noted. It should also be noted that Worsley already pay compensation to CALM for the disturbance of forest areas. These compensation payments may be used for this type of research and management initiatives.

#### 4.2.15 Health issues

Item	Submission	Response
163	<p>Issues pertaining to health are well addressed, with the assessment methods adopted being generally well justified.</p> <p>(Department of Health, received 9 August 2005)</p>	Noted.
164	<p>Further matters relevant to public health and well being, predominately potential noise, dust and water resource impacts, are also considered to have been appropriately investigated. The management strategies committed to by Worsley Alumina in the ERMP are anticipated to adequately ensure that public health is protected.</p> <p>(Department of Health, received 9 August 2005)</p>	Noted.
165	<p>Appendix 10 (Health Risk Assessment) of ERMP</p> <p>See Attachment 1. Eg, Text following Tables 3 and 8. The methodology and conclusions appears acceptable and suitably conservative, but requires Health Department acceptance.</p> <p>(Department of Environment South West Division, received 9 August 2005)</p>	Department of Health submission raises no significant items.

#### 4.2.16 Radiation

Item	Submission	Response
166	<p>The Council has no objections to the proposal. However, please note that the following matters will need to be discussed directly with the Radiological Council:</p> <ul style="list-style-type: none"> <li>• Should the proponent ascertain any use for the bauxite residue, a proposal will need to be submitted to the Radiological Council for approval, along with the results of radionuclide analysis.</li> <li>• The closure plan will need to be submitted to the Radiological Council, particularly with respect to the rehabilitation of the bauxite residue disposal areas, along with the results of radionuclide analysis.</li> </ul> <p>(Radiological Council, 1 August 2005)</p>	Noted.

#### 4.2.17 Impact on organic farming

Item	Submission	Response																				
167	<p>Will emissions impact on neighbouring organic farming operations (i.e. affect their certification)?</p> <p>(Shire of Collie, received 10 August 2005)</p>	<p>Emissions modelling, prediction of ground level concentration of substances and the health risk assessment undertaken for the expansion has been on the basis of a conservative assessment of the impact on public health.</p> <p>Worsley understands that the predominant requirement for attaining and maintaining organic accreditation is to prevent residues in or on produce that are due to farm inputs (Australian Certified Organic 2003), and minimise residues that may be due to ambient conditions. While the assessment of air emissions has been on the basis of public health, Table 5.11 in the ERMP provides a comparison of the maximum ground level concentrations of substances for existing refinery operations, and those predicted for expanded operations. Substances that may be considered to potentially impact on residue levels of produce could be heavy metals and persistent compounds such as dioxins/furans, and possibly particulate matter.</p> <p>Analysis of the predicted ground level concentrations of persistent substances emitted from the refinery shown in Table 5.11 of the ERMP indicates only very small increases in the concentration of metals, persistent compounds and particulate matter. A summary of these changes is shown below. It is considered unlikely that changes in emissions due to the proposed expansion are likely to result in any changes in residues in or on farm produce. It should also be noted that the ground level concentrations shown in the following table represent maximum values from within an approximate 15 x 15 km grid surrounding the refinery. The predicted ground level concentrations at the organic farming property may be less than those provided in the table.</p> <table border="1" data-bbox="1099 821 1845 1227"> <thead> <tr> <th data-bbox="1099 821 1261 1007">Substance</th> <th data-bbox="1261 821 1458 1007">Maximum annual average ground level concentration for existing operations (ug/m<sup>3</sup>)</th> <th data-bbox="1458 821 1655 1007">Maximum annual average ground level concentration for expanded operations (ug/m<sup>3</sup>)</th> <th data-bbox="1655 821 1845 1007">Increase in annual average ground level concentration (ug/m<sup>3</sup>)</th> </tr> </thead> <tbody> <tr> <td data-bbox="1099 1007 1261 1043">Arsenic</td> <td data-bbox="1261 1007 1458 1043">2x10<sup>-5</sup></td> <td data-bbox="1458 1007 1655 1043">2.5x10<sup>-5</sup></td> <td data-bbox="1655 1007 1845 1043">5x10<sup>-6</sup></td> </tr> <tr> <td data-bbox="1099 1043 1261 1106">Dioxins and Furans</td> <td data-bbox="1261 1043 1458 1106">6.2x10<sup>-11</sup></td> <td data-bbox="1458 1043 1655 1106">7.3x10<sup>-11</sup></td> <td data-bbox="1655 1043 1845 1106">1.1x10<sup>-11</sup></td> </tr> <tr> <td data-bbox="1099 1106 1261 1142">Mercury</td> <td data-bbox="1261 1106 1458 1142">5.1x10<sup>-4</sup></td> <td data-bbox="1458 1106 1655 1142">6.9x10<sup>-4</sup></td> <td data-bbox="1655 1106 1845 1142">1.8x10<sup>-4</sup></td> </tr> <tr> <td data-bbox="1099 1142 1261 1227">Particulate matter (&lt;2.5 um)</td> <td data-bbox="1261 1142 1458 1227">0.062</td> <td data-bbox="1458 1142 1655 1227">0.064</td> <td data-bbox="1655 1142 1845 1227">0.002</td> </tr> </tbody> </table>	Substance	Maximum annual average ground level concentration for existing operations (ug/m <sup>3</sup> )	Maximum annual average ground level concentration for expanded operations (ug/m <sup>3</sup> )	Increase in annual average ground level concentration (ug/m <sup>3</sup> )	Arsenic	2x10 <sup>-5</sup>	2.5x10 <sup>-5</sup>	5x10 <sup>-6</sup>	Dioxins and Furans	6.2x10 <sup>-11</sup>	7.3x10 <sup>-11</sup>	1.1x10 <sup>-11</sup>	Mercury	5.1x10 <sup>-4</sup>	6.9x10 <sup>-4</sup>	1.8x10 <sup>-4</sup>	Particulate matter (<2.5 um)	0.062	0.064	0.002
Substance	Maximum annual average ground level concentration for existing operations (ug/m <sup>3</sup> )	Maximum annual average ground level concentration for expanded operations (ug/m <sup>3</sup> )	Increase in annual average ground level concentration (ug/m <sup>3</sup> )																			
Arsenic	2x10 <sup>-5</sup>	2.5x10 <sup>-5</sup>	5x10 <sup>-6</sup>																			
Dioxins and Furans	6.2x10 <sup>-11</sup>	7.3x10 <sup>-11</sup>	1.1x10 <sup>-11</sup>																			
Mercury	5.1x10 <sup>-4</sup>	6.9x10 <sup>-4</sup>	1.8x10 <sup>-4</sup>																			
Particulate matter (<2.5 um)	0.062	0.064	0.002																			



**4.2.18 Impacts on landowners**

Item	Submission	Response
168	The impacts of any expansion at Worsley on landowners within this Shire are relatively minor compared to those at Wagerup, due to the significant distance to any private land from the Refinery. Staff estimates that the closest private property to the refinery within the Shire of Harvey is approximately 5 kilometres away. (Shire of Harvey, received 3 August 2005)	Noted.
169	Issues previously raised by Council with respect to the Worsley ERMP include:- • Questions regarding Worsley's future land acquisition policies. (Shire of Harvey, received 3 August 2005)	The Worsley Joint Venture maintains a significant holding of private land nearby the Worsley Refinery and the Boddington Bauxite Mine. This private land has been acquired to provide both access to bauxite resource and to maintain sufficient separation distance between project operations and potentially sensitive premises. Any future land acquisitions that may be required will be in accordance with existing requirements.

**4.2.19 Other environmental issues**

Item	Submission	Response
170	There is no mention of acid mine drainage in the ER [Environmental Review], particularly in relation to the waste dump. It is not clear in the ER about the presence of pyritic shales in the mining operations. The Proponent needs to clarify whether acid mine drainage is an issue or not an issue. (Department of Environment South West Division, received 9 August 2005)	The laterite profile from which bauxite is mining is a highly oxidised and leached profile. Some acid forming potential may exist in deep parent material that is undisturbed at least 15-20 metres below the laterised material. No parent material is exposed by mining so acid forming potential is very low.

## 4.3 OTHER ISSUES

### 4.3.1 General issues

Item	Submission	Response
171	<p>Staff suggests that other issues raised within the discussion paper prepared for the Wagerup ERMP relating to compliance, emissions and greenhouse gas emissions should also be highlighted to the EPA.</p> <p>(Shire of Harvey, received 3 August 2005)</p>	<p>The Shire of Harvey submission notes that issues raised in its submission prepared for the proposed expansion of the Wagerup Refinery may be relevant to the Worsley expansion, in particular those issues relating to compliance, emissions and greenhouse gas emissions.</p> <p>Worsley acknowledges that there may be similar environmental factors between the Wagerup and Worsley proposals, but wishes to point out that the Shire of Harvey submission raises a number of specific issues that are applicable to Wagerup and not Worsley, e.g. studies undertaken, distance to potentially sensitive premises, water supply and land management etc.</p> <p>Air emissions and greenhouse gas emissions that are applicable to the Worsley project are detailed in Chapter 5, Section 2 and Chapter 2, Section 4 of the ERMP respectively. In respect of monitoring compliance, the Worsley project has obligations for reporting compliance under conditions of its Ministerial Approval, Environmental Licences and Agreement Act. Worsley has obligations to undertake compliance monitoring and is required to report any non-compliance. The project Annual Environmental Report and Public Health, Safety, Environment and Community Report both publicly report on project compliance. In addition, the EMLG, as required by Ministerial Statement 423, will advise the Minister for the Environment through the Minister for State Development on compliance with environmental conditions.</p>
172	<p>CALM notes that the use of the terms "wherever practicable" and "minimise" in relation to commitments do not provide for auditable commitments and recommends that all conditions and commitments are to the requirements of the Minister for the Environment.</p> <p>(CALM, received 3 August 2005)</p>	<p>Matter to be addressed by the EPA.</p>
173	<p>MINOR COMMENTS</p> <ul style="list-style-type: none"> <li>• Executive Summary Pg 12. Mining Process, Rehabilitation and Mining Rate. - The last paragraph shows a production increase of approximately 20% and an increase of land clearing of 70%. This apparent inconsistency needs to be clarified.</li> <li>• Utilisation of Forest Residue. Executive summary page 12 and Volume 1 chapter 2 page 24. - There is an opportunity to formalise a target to not burn any residue after a specified number of years and pursue other uses for the forest debris including incorporation in the rehabilitation soil profile if appropriate. This would also assist in reducing greenhouse emissions.</li> <li>• Fauna Habitat Zones (Vol 1 chapter 2 page 8). CALM's understanding is that Worsley, in negotiations with the Conservation Commission, has established the indicative fauna habitat zones. The formalised fauna habitat zones will be established post exploration and mining.</li> </ul> <p>(CALM, received 3 August 2005)</p>	<p>The density of bauxite in the new mining areas (based on granitic parent material as opposed to greenstone) is lower than within the Primary Bauxite Area. Therefore a greater area of land is required to be cleared to meet required bauxite tonnages.</p> <p>Worsley has continued to implement measures to reduce burning of forest residue. These measures are reported in Annual Environmental Reports.</p> <p>The process of establishing fauna habitat zones described in the submission is correct.</p>

Item	Submission	Response
174	VOLUME 1, Chapter 2, Top dot point, p 2-15 of ERMP Should read DoE "(including relevant Water and Environment licensing officers; and Response and Audit, and Mining Assessments branch officers)" OR preferably left as DoE only. (Department of Environment South West Division, received 9 August 2005)	Noted.
175	VOLUME 1, Chapter 2, Page 2-24 of ERMP Unclear what is meant by "-e" after CO <sub>2</sub> tonnage, as used several times. (Department of Environment South West Division, received 9 August 2005)	CO <sub>2</sub> -e refers to carbon dioxide equivalent and takes into account the global warming potential of other non-CO <sub>2</sub> substances, eg methane.

### 4.3.2 Approval process

Item	Submission	Response
176	The submission suggests an approach utilising a further program of biological survey, impact assessment and planning to support a staged or incremental development approval process, which could be applied as an implementation requirement of an overall strategic approval. CALM understands and accepts that it will take considerable time and effort to acquire the necessary information and accepts that project timelines provide that opportunity. However, it is a matter for the EPA to determine if the timeframe of gathering and presenting the necessary information proposed can be judged as adequate to provide for protecting biodiversity values and to provide certainty of outcomes into the future, in a transparent and effective manner. CALM would prefer that all studies are completed and analysed for assessment in the ERMP, but we would be pleased to work with the EPA to develop a framework for a staged approach to assessing environmental and conservation impacts, if the EPA considers such an approach acceptable. (CALM, received 3 August 2005)	See general text in section 3.
177	VOLUME 1, Chapter 1, Section 1.4 (last paragraph), p 1-4 The form of the approval to mine under "emergency circumstances" should be given (eg Ministerial condition number). There is limited land within the refinery lease that could be accessed in this way, and impacts on FWL [Freshwater Lake] water quality and wastewater containment facilities are possible. Suggest this "approval" be reviewed. (Department of Environment South West Division, received 9 August 2005)	A Notice of Intent (NOI) to undertake mining during a period of prolonged shut down of the overland conveyor system was referred to the Chief Mining Engineer in 1999. The NOI was forwarded to the EPA to provide comment. The proposal was not determined as requiring formal assessment under the EP Act. Approval was subsequently obtained.
178	VOLUME 1, Chapter 1, Section 4.3.2, p 1-37 of ERMP The words "subject of a separate referral", regarding gas cogeneration, is used here and elsewhere. When, how and where will this separate referral occur? (Department of Environment South West Division, received 9 August 2005)	The gas fired cogeneration option was referred to the EPA in April 2005. The referral has been determined to be assessed on referral information. At the time of preparing this response the EPA has released its Bulletin and draft recommendations to the Minister for the Environment. The level of assessment and recommendations are the subject of a two week appeal period.

## 5. SUBMISSIONS FROM NON-GOVERNMENTAL ORGANISATIONS

### 5.1 GENERAL

#### 5.1.1 General comments

Item	Submission	Response
179	<p>I would like to congratulate the authors, EPA and Worsley Alumina for the preparation of such a comprehensive report and the efforts made to consider the impact of the proposed expansion upon all stakeholders. The time and commitment to producing such a report is to be commended.</p> <p>(All Dog Sledding and Carting Club of Western Australia, received 3 August 2005)</p>	Noted.
180	<p>You have already received a submission from Mr David G Osborne dated 1 August 2005 relating to this ERMP. Mr Osborne is a member of Perth Bushwalkers Club Inc, the largest club in the Federation of Western Australian Bushwalkers Inc. The Federation thoroughly supports all the comments made by Mr Osborne in his submission, and where he talks specifically of his own activities and the activities of Perth Bushwalkers Club Inc then these comments should be extended to all the bushwalking clubs in WA and many bushwalkers in WA.</p> <p>We are aware that there are many 'bushwalkers' who are not part of our federation, however in this response we have attempted to consider the needs of the entire walking community, not just our affiliated members.</p> <p>(Federation of Western Australian Bushwalkers Inc, received 3 August 2005)</p>	<p>Noted.</p> <p>Refer to responses to Mr Osborne's submission in Section 6.</p>

#### 5.1.2 Objection to the proposal

Item	Submission	Response
181	<p>An industry that cannot be justified</p> <p>Bauxite mining and alumina refining based on the world's only jarrah forest are an assault on the environment and the community that should never have been permitted. At the scale the industry wants to operate and even at its current level it will leave a legacy of environmental destruction and community ill-health and disruption that no amount of donations, sponsorships, royalties, taxes or jobs can ever justify.</p> <p>Against this background, the Conservation Council states its total opposition to the proposed increase in the rate of mining and expansion of mining operations at the Worsley refinery from 3.7 Mtpa to 4.4 Mtpa, a 20 per cent increase (Executive Summary, p. 3).</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	Submission raises no specific issue that can be responded to.

Item	Submission	Response
182	<p>The proposed expansion, from 13.5 Mtpa to 16.5 Mtpa, a 20 per cent increase (Executive Summary, p. 12), would have significant environmental impacts. Furthermore, the environmental situation has changed markedly during the life of this mine, which began in 1984. The rainfall has declined by about 20 per cent since the 1970s and is anticipated to continue declining (by up to 60 per cent by 2070). The forest ecosystems are under severe stress, with tuart and wandoo suffering serious decline and marri widely affected by canker. In the light of these changed conditions the impacts of accelerated mining cannot be tolerated.</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley acknowledges the significance of the scale of its operations and potential for environmental impacts. Accordingly, Worsley maintains a certified Environmental Management System and operational procedures that address management of all potential environmental impacts. Worsley also acknowledges the potential impacts that declining rainfall may have on the project and is committed to inclusion of climatic considerations in particular in the management of water resources by significantly improving water use efficiency and in the management of rehabilitation programs.</p>

### 5.1.3 Stakeholder consultation

Item	Submission	Response
183	<p>Identification of our club and members as stakeholders may have slipped under the radar due in part to the nature of this growing sport.</p> <p>The ADSC [All Dog Sledding and Carting Club of WA] committee would appreciate the opportunity to meet with relevant personnel to discuss the likely impact of the proposed expansion upon our activities and consequent management strategies to solve any identified issues.</p> <p>I look forward to your future correspondence regarding the potential issues raised in this submission and hope that we can work together to find solutions which meet the needs of all parties involved.</p> <p>(All Dog Sledding and Carting Club of Western Australia, received 3 August 2005)</p>	<p>Worsley thanks the All Dog Sledding and Carting Club of WA for identifying their club as an interested stakeholder group. Worsley welcomes and encourages the participation of the club, and other relevant organisations, in future stakeholder consultation. Worsley acknowledges that such stakeholder groups can provide valuable input to the mine planning process.</p> <p>See also detailed responses in Section 3.</p>
184	<p>The Federation of Western Australian Bushwalkers Inc has very recently become aware of this ERMP and would like to take the opportunity to comment. One of our member clubs, Perth Bushwalking Club Inc, of which coincidentally I [Ian McDonald] am President, was approached for information by a researcher and was able to tell of walk trails and aboriginal stone arrangements, but since the researcher declined to reveal the purpose of the enquiries, the information given was not complete. The Federation, and Perth Bushwalkers Club would have liked to have been given the opportunity to contribute to the ERMP earlier, and perhaps there would have been advantages for all parties had this happened.</p> <p>(Federation of Western Australian Bushwalkers Inc, received 3 August 2005)</p>	<p>Worsley notes the comments from the Federation of Western Australian Bushwalkers Inc and welcomes and encourages the participation of the group, and other bushwalkers and nature based organisations, in future stakeholder consultation. Worsley acknowledges that such stakeholder groups can provide valuable input to the mine planning process.</p> <p>See also detailed responses in Section 3.</p>
185	<p>Ultimately we are very concerned that the mining activities proposed do not reduce opportunities for access to these areas, and when any road closures are contemplated we would like to be consulted.</p> <p>We would be happy to meet with you or with Worsley representatives to further explain any of the points raised by Mr Osborne and this letter.</p> <p>(Federation of Western Australian Bushwalkers Inc, received 3 August 2005)</p>	<p>Worsley acknowledges the "network of forestry tracks in the Northern Jarrah Forest has moderate public usage for accessing activities such as bushwalking, camping and trail bike riding" and that mining operations may require temporary closure of some forestry tracks, possibly prohibiting access to some sites used for recreational pursuits (Volume 1, Section 8.3.2, pg 3-113 of the ERMP).</p> <p>Worsley will undertake comprehensive stakeholder consultation during the mine planning process to identify and mitigate potential impacts, such as public access to forest areas (see detailed response in Section 3). In addition, the CALM-Worsley Working Arrangements will continue to provide the mechanism for managing access to State Forest and forest pursuits during the periods between site preparation and rehabilitation (Volume 1, Section 8.3.2, pg 3-113 of the ERMP).</p>

## 5.2 ENVIRONMENTAL FACTORS ADDRESSED IN ERMP

### 5.2.1 Flora and vegetation

Item	Submission	Response
186	<p>Worsley is preventing Western Australians from having a truly comprehensive, adequate and representative conservation reserve system in the northern jarrah forest, determined on ecological grounds. It made the Government draw the boundaries of proposed conservation reserves under both the Regional Forest Agreement and the 2004-2013 Forest Management Plan to accommodate its mining plans and it can control the location of Fauna Habitat Zones in the northern jarrah forest (Environmental Review, 2-8, Executive Summary, p. 14). The EPA must use the very real environmental harm that Worsley already causes to hold the company to its current production level.</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley has relinquished significant areas from the granted Mining Lease for conservation purposes. These relinquishments are outlined in the ERMP in Volume 1, Chapter 2, Section 2.4. Under the Regional Forest Agreement and Forest Management Plan referred to, Worsley has agreed to relinquish 7,629 ha, in addition to 12,810 ha previously relinquished for conservation purposes.</p>
187	<p>There would be a significant increase in the area of jarrah forest destroyed (from 140 ha/yr to about 240 ha/yr, Executive Summary, p. 12). Worsley's licence runs until 2046, i.e. for another 41 years. The project life is said to be 30-35 years (Executive Summary, p. 9). At the increased rate of production, this would mean an extra 8,500 ha of jarrah forest destroyed, in addition to the 2,150 ha already destroyed. Worsley's legacy would be some 10,000 ha of jarrah forest destroyed by mining alone, with more areas lost for other purposes such as access, toxic waste dumps.</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley has obligations under the Agreement Act to progressively rehabilitate areas disturbed by mining operations, and also pays compensation for areas of State Forest disturbed.</p>
188	<p>The expanded bauxite mining operations require conveyor extensions of some 78 km (Environmental Review, 1.31). This would require the clearing of up to 289 ha (Ibid.) and result in further fragmentation of the forest ecosystem.</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>Areas of bauxite within the proposed new mining areas occur as discrete mine pods and allow the maintenance of forested areas in and around mine pods. In effect only discrete pockets of vegetation are proposed to be disturbed. Worsley has also committed to the establishment of fauna habitat zones throughout the mining lease.</p>

### 5.2.2 Biodiversity

Item	Submission	Response
189	<p>There would be an increase in area of jarrah forest fragmented. Fragmentation of the remaining jarrah forest adds to the harmful impacts of destruction of forest as it separates populations of flora and fauna that do not disperse readily and may reduce the size of forest remnants to levels that cannot support viable populations. The long-term impacts of forest fragmentation on the forest's biodiversity, on top of forest destroyed, are unknown.</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>See response to item 188.</p>

Item	Submission	Response
190	<p>Very little is known about the below-ground biota such as fungi, or its role in ecosystem health. The impact of mining on the unknown species is therefore unknown and thus Worsley's aim of regenerating a stable forest ecosystem (Executive Summary, p. 12) is probably unachievable.</p> <p>No mention is ever made of the native vegetation from which seed is taken to supply Worsley's requirements for rehabilitation, or of the environmental impacts of the removal of this seed (both the physical process and the loss to the environment). (Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley has established several research programs investigating soil biota in conjunction with Murdoch University and the University of WA. These programs are investigating ectomycorrhizal diversity in soil, the importance of mycorrhiza in establishing vegetation and nutrient cycling due to microbial activity. Such research programs are a component of Worsley's research and development programs aimed at optimising rehabilitation performance.</p> <p>Seed is collected under licence from CALM and in accordance with practices that ensure sustainability of the local forest. Seed is obtained from local provenance species, in mature forest surrounding and within existing mining operations.</p>
191	<p>Bauxite mining will almost certainly increase the spread of Phytophthora dieback. More mining will mean more spread. This will have serious impacts on the biodiversity of the jarrah forest. The inclusion of "Reasonable and practicable actions" in a Forest Disease Management Plan to minimise the risk of introducing and spreading forest disease (Executive Summary, p. 43) is no assurance in the face of this killer pathogen. (Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley acknowledges the potential impacts that spread of forest disease would have on biodiversity. Accordingly, Worsley has developed and implemented strict forest hygiene and control measures to minimise the spread of forest disease. These procedures are outlined in the ERMP Volume 1, Chapter 3, Section 2.4.2. Worsley's operations in the forest over the last 25 years have not resulted in any observed increase in spread of forest disease.</p>

### 5.2.3 Salinity

Item	Submission	Response
192	<p>Bauxite mining increases the risk of salinity. The water table rises in response to mining on average between 5.5 and 10 metres (Executive Summary, p. 18). With south-west WA's water resources already strained beyond their limits, any threat to the water supply must be totally opposed. (Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley has undertaken a salinity risk assessment and committed to implementing a water resources management plan. Details are provided in the ERMP Volume 1, Chapter 3, Section 4.</p>

### 5.2.4 Water resources

Item	Submission	Response
193	<p>The expansion would increase Worsley's use of water (fresh water use would increase from 2.1 GL/a to 3.1 GL/a), which could well be put to better use. (Conservation Council of WA, received 9 August 2005)</p>	<p>The ERMP shows that water usage at the refinery is to remain the same under average rainfall conditions (Volume 1, Chapter 1, Section 4.3.6) and will only increase following a period of prolonged low rainfall conditions. This same situation applies to the refinery at current production levels. The number of 3.1 quoted here appears to be an outdated number.</p>

### 5.2.5 Air emissions

Item	Submission	Response
194	The refinery pours pollutants, both chemical and particulate, into the atmosphere, including mercury (Environmental Review, 1.23, 5.16 - 19; Executive Summary, pp. 34-36). Many of these will increase, especially with a coal-fired boiler. (Conservation Council of WA, received 9 August 2005)	Worsley acknowledges the increase in some criteria pollutants within the ERMP. Some substances (eg VOCs and odour) emitted to air will be decreased following the expansion due to improved emission control system. Worsley has undertaken detailed development of a refinery emission inventory, air dispersion modelling and a comprehensive health risk assessment as described in Volume 1, Chapter 5, Section 2 of the ERMP. These investigations conclude that the proposed expansion unlikely to impact on public health and amenity.
195	Air pollution from the refinery sends foul smells, euphemistically called 'odour', over a wide area (Environmental Review, 1.37). These are not just unpleasant. They are so bad they can cause ill health. These would increase with the expansion (Ibid., 1.23). (Conservation Council of WA, received 9 August 2005)	See response to item 194.

### 5.2.6 Noise

Item	Submission	Response
196	There would be an increase in noise from mining, including blasting and transport (the duration of conveyor's operations will increase from 116 to 140 hours per week, (Environmental Review, 1.30) and from the refinery. (Conservation Council of WA, received 9 August 2005)	Worsley acknowledges that noise emissions arise from project operations. Management of noise is presented for each of the project operational areas at the mine, the conveyor system and at the refinery within the ERMP. Worsley's noise management program is required to ensure compliance with statutory requirements relating to noise emissions contained within the <i>Environmental Protection (Noise) Regulations 1997</i> and the Agreement Act.

### 5.2.7 Bauxite residue

Item	Submission	Response
197	The expansion would mean an increase in the amount of residue. Worsley has already produced some 55 Mt of residue (Legislative Council Question on Notice No. 2001 of 2004). It doesn't know what to do with the waste it is already producing at the rate of 5.5 Mtpa (ibid.) (11.8 Mtpa, wet, Environmental Review, 1.38) so what will it do with an extra 20 per cent? (Conservation Council of WA, received 9 August 2005)	Bauxite residue disposal facilities have been designed to contain all residue from minable bauxite reserves. Residue is disposed according to the approved residue disposal plan. The proposed expansion speeds up the rate of mining and consequently the rate of residue deposition. As described in Volume 1, Chapter 1, Section 4.3.4 of the ERMP, no additional residue disposal facilities area required for the expansion.
198	The expansion would mean an increase of 30 ha for residue disposal (toxic waste). To date toxic waste dumps cover some 350 ha (Legislative Council Question on Notice No. 2001 of 2004). Besides taking up land that would be better used for other purposes, the dumps may leak pollutants into ground and surface water, and the dust that blows off them spreads harmful chemicals onto people, animals, homes and farmland. These problems must be corrected before any extension of their area is permitted. (Conservation Council of WA, received 9 August 2005)	See response to item 197. No additional area is required.



## 5.2.8 Greenhouse gas emissions

Item	Submission	Response
199	<p>Greenhouse gas emissions would increase from 2.6 Mtpa to 3.7 Mtpa (Environmental Review, 2.24 - 26). Of particular concern is the increase in anticipated greenhouse gas emissions from the liquor burning facility, from 6,000 tpa to 39,600 tpa (Executive Summary, p. 7).</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>The increase in emissions from the liquor burner are not due to increased throughput. The greenhouse inventory for existing operations has been prepared during a period when the liquor burner was not fully operational. Regardless of refinery production being at 3.5 or 4.4 Mtpa, if the liquor burner were to be fully operational it would emit around 39,600 tpa.</p>

## 5.2.9 Recreation

Item	Submission	Response
200	<p>This area represents a valuable asset to this club and the sport in general. It is extremely difficult to find suitable tracks for Sledding or Carting that meet the needs of the sports yet avoid water catchment areas or national parks. The tracks in this area met the needs of both sports and provide a selection of tracks of varying distances and terrain to cater for beginners, intermediate and experienced teams. ADSC [All Dog Sledding and Carting Club of WA] members have been using these tracks in preparation for interstate competitions.</p> <p>I am pleased to note that one objective is to ensure existing and planned recreational uses are not compromised and part of the management strategy to reduce the impact of the proposed expansion includes the realignment, redevelopment or the establishment of new trails.</p> <p>(All Dog Sledding and Carting Club of Western Australia, received 3 August 2005)</p>	<p>Noted.</p>
201	<p>We would also like to add that walks in these areas would be classed as grade five and grade six, using the classification system developed by Standards Australia. Navigation in these areas may be by GPS, by map and compass, or by following the lay of the land – again at the discretion of the leader, and depending on the skills held by the walkers involved. Using such practices an area can be used extensively with very little impact on the bush, and very little to show for the passage of walkers. Simply because a cursory glance does not show a 'Bibbulmun Track' style walking trail it does not mean that an area is not used for bushwalking.</p> <p>We would like to add however that the maps he [Mr David Osborne] shows [in his separate submission] of popular walking areas likely to be effected by the mining activities discussed in the ERMP do not show that the approaches to these areas may be, at the discretion of the leader, from some other direction.</p> <p>(Federation of Western Australian Bushwalkers Inc, received 3 August 2005)</p>	<p>Worsley acknowledges that although there are few formal recreational sites/areas (e.g. sites typically identifiable with roadside signage and/or user facilities) within the Northern Jarrah Forest, the forest is widely used for informal recreational pursuits (Volume 1, Section 8.2.2, pg 3-110 of the ERMP) and recognises the difficulty in quantifying informal usage of the forested areas of the Northern Jarrah Forest.</p> <p>The intent of identifying the "walk trails" in the ERMP and in Figure 3.17 (Volume 1, pg 3-111) was to identify areas where bushwalking is known to be undertaken and to highlight the wide-use of the forested areas for bushwalking; it was not intended to indicate the full extent of bushwalking use of the forest.</p>

### 5.2.10 European heritage and culture

Item	Submission	Response
202	<p>The following features involving recreational trails and European heritage are not included in the ERMP documents.</p> <ol style="list-style-type: none"> <li>1. Hotham Branch Line. The disused historic railway line dissects the northern section of the Marradong mining envelope. It is proposed to re-establish this line as a tourist railway.</li> <li>2. Tullis Bridge. A timber trestle bridge that served to carry the Hotham Branch Line railway across the Hotham River from 1912 to 1968. The bridge is listed in the Municipal Heritage Inventory prepared by the Shire of Boddington.</li> <li>3. Tullis Walk Trail. A short bush walking trail in the area, established by the Shire of Boddington, Boddington Development Group and funded by Lotterywest. This trail will be an attractive activity for the rail patrons.</li> </ol> <p>The above features could be affected by future mining activities and/or the transport of mined ore and associated works.</p> <p>Various references are made to European Heritage and recreational facilities throughout the ERMP documents, however Tullis Bridge, the historic Hotham Branch Line and the Tullis Walk Trail have not been included. The [Rail Heritage Foundation] RHF assume this is due to the area not being within the proposed new mining/transport corridor envelopes.</p> <p>The RHF is unclear as to the relevance of the above items in terms of being affected by the proposed new mining areas and transport corridor. It appears however that the proposals contained in the review of the current primary bauxite area may affect the usefulness and integrity of the above items.</p> <p>(Rail Heritage Foundation of WA Inc. RHF, received 10 August 2005)</p>	<p>The assessment of heritage values in the ERMP has focussed on new mining envelopes. The Heritage features referred to in the submission occur in the vicinity of the existing approved Primary Bauxite Area. As such, Worsley will take into account heritage issues associated with the Rail Heritage Foundation (RHF) in the vicinity of any mine areas. Worsley has been to date a participant in the development of proposal by the RHF in the Boddington area. As referred to in the submission, Worsley is and will remain represented on the Board of the RHF and is entering into a deed of consent to provide support to the activities of the RHF in the area while retaining rights to carry out mining and related activities.</p>

Item	Submission	Response
203	<p>A key group of stakeholders has well-established plans to re-construct the historic Hotham Branch Line as a tourist railway. This project is widely known as the Peel Region Tourist Railway [PRTR] and consists of existing and planned infrastructure and reserves from Pinjarra to Boddington. The State Government has provided \$3.23m toward infrastructure development since 1998 and of this \$1m was granted to assist in the development of the Boddington section of the project, including Tullis Bridge. The Department of Transport and Regional Services are currently considering an application from the RHF to the Federal Government for a further contribution of \$845,000 to the project in 2005/06 and 2006/07. In addition the State is also committed to a further \$345,000 in 2006/07. Tullis Bridge and the surrounding area are critical to the project.</p> <p>In consultation with the RHF, Worsley Alumina P/L has developed a draft Deed of Consent designed to support the PRTR project whilst also protecting their right to conduct mining and/or related activities.</p> <p>WAP/L has representation on the Board of the RHF.</p> <p>The key stakeholders in the project are:</p> <ul style="list-style-type: none"> <li>• Rail Heritage Foundation of WA Inc</li> <li>• Boddington Shire Council</li> <li>• Peel Development Commission</li> <li>• Murray Shire Council</li> <li>• Hotham Valley Tourist Railway</li> <li>• The State and Federal Governments as principal funding contributors.</li> </ul> <p>This group has an interest in ensuring that continued access to the features and through the area is maintained.</p> <p>(Rail Heritage Foundation of WA Inc. RHF, received 10 August 2005)</p>	<p>Worsley will continue to participate in the activities of the board of the RHF.</p>

### 5.2.11 Spread of disease

Item	Submission	Response
204	<p>Bauxite mining will almost certainly increase the spread of Phytophthora dieback. More mining will mean more spread. This will have serious impacts on the biodiversity of the jarrah forest. The inclusion of "Reasonable and practicable actions" in a Forest Disease Management Plan to minimise the risk of introducing and spreading forest disease (Executive Summary, p. 43) is no assurance in the face of this killer pathogen.</p> <p>(Conservation Council of WA, received 9 August 2005)</p>	<p>Worsley acknowledges the potential impacts that spread of forest disease would have on biodiversity. Accordingly, Worsley has developed and implemented strict forest hygiene and control measures to minimise the spread of forest disease. These procedures are outlined in the ERMP Volume 1 Chapter 3 Section 2.4.2 of the ERMP. Worsley's operations in the forest over the last 25 years have not resulted in any observed increase in spread of forest disease.</p>

## 6. INDIVIDUAL PUBLIC SUBMISSIONS

### 6.1 GENERAL

#### 6.1.1 Stakeholder consultation

Item	Submission	Response
205	<p>It appears that Stakeholder Consultation may not have extended to some key community groups, including nature-based organisations such as the Perth Bushwalkers Club who have an obvious interest in the recreational values of most of the forested areas of the Darling Range, including those that will be affected, or potentially affected by the proposed mine expansion activities.</p> <p>“Management measures” intended to reduce adverse recreational impacts (as summarized in Executive Summary, page 23, under dot points) needs to include as an additional dot point: “advance consultation with recreational stakeholders prior to finalizing mining plans for a potentially affected area”.</p> <p>The “vegetation protection strategy” (as summarized in Executive Summary, page 23, under dot points) needs to include as an additional dot point: “identifying areas of visual/aesthetic significance to recreational stakeholders” (i.e. not only “areas of “conservation significance” as currently).</p> <p>The Proponent’s continuing practices for managing the “visual impact” of mining operations (as summarized in Executive Summary, page 24, under dot points) need to be expanded by addition of a dot point with the following words: “consult with stakeholders to establish the intrinsic scenic amenity value of existing landscapes and avoid wherever possible damage or loss of natural features (e.g. laterite breakaways and mature wandoo woodlands) that have significant scenic and recreational value”.</p> <p>(David Osborne, received 3 August 2005)</p>	See general responses in Section 3.
206	<p>Commitment # 10 (Project Wide, page 45) : Noise &amp; Vibration</p> <ul style="list-style-type: none"> <li>• “Community consultation” needs to be extended to specifically include recreational stakeholders, not only nearby residents/occupants of “noise sensitive premises” (as referred to on page 27).</li> </ul> <p>Commitment # 14 (Transport corridor, page 45) : Noise</p> <ul style="list-style-type: none"> <li>• “Community consultation” needs to be extended to specifically include recreational stakeholders, not only occupants of “noise sensitive premises” (as referred to on page 27).</li> </ul> <p>The summary of “Environmental management” (page 52) needs to also state the following :</p> <ul style="list-style-type: none"> <li>• “Consultation with stakeholders to identify in advance of mining to identify natural features of significant scenic and recreational amenity value”</li> </ul> <p>(David Osborne, received 3 August 2005)</p>	See general responses in Section 3.

Item	Submission	Response
207	<p>For the reasons I have noted above, I believe nature-based organizations such as Perth Bushwalkers should have been specifically invited to comment on the ERMP. I recommend that their advice and input should still be obtained and considered in due course.</p> <p>The ERMP notes (e.g. Executive Summary, page 5) that the independently chaired Community Liaison Committees are “a primary focus for input to the ERMP and project activities including the development of environmental management measures”.</p> <p>Given the significance of the mining expansion to bushwalking groups and to individual bushwalkers, it would be appropriate to invite bushwalking groups to have representation on a relevant Community Liaison Committee (despite some difficulties for physical representation due to the location of the committees at the refinery or Boddington).</p> <p>(David Osborne, received 3 August 2005)</p>	See general responses in Section 3.
208	<p>The statement on page 30 of the ERMP that the transport corridor “will not significantly detract from the visual amenity values...due to the existence of other cleared linear corridors in the region (e.g. roads...)” understates the impact that a new corridor will have on the visual amenity in the Upper Dale and Bannister Hill areas. The potential impact in those areas should be clearly and specifically flagged in the ERMP to ensure proper stakeholder consultation during final corridor planning.</p> <p>In view of the potential confusion (as noted above) between existing “trails” and “known walk areas”, the ERMP Executive Summary needs to add another dot point under the possible actions (at bottom of page 29, under Recreation, and elsewhere), to read as follows: “further consultation with stakeholders in instances where the proposed transport corridor will have potential impacts upon known walk areas”.</p> <p>(David Osborne, received 3 August 2005)</p>	See general responses in Section 3.
209	<p>This public access issue [access to forest areas for recreational pursuits] has not been adequately addressed in the ERMP and must be made a key item also for consultation with stakeholders.</p> <p>(David Osborne, received 3 August 2005)</p>	See general responses in Section 3.
210	<p>I was contacted in June/July 2004 during the ERMP preparation by Worsley’s consultant. I was apparently contacted due to the relevance of my ‘WalkGPS’ website to the consultant’s work. My response to the consultant was minimal in the context of what is relevant to the ERMP. That was because the consultant did not declare the background or specific purpose for which the information was ultimately to be used (including for which organisation) and asked only two questions on two walk areas.</p> <p>(David Osborne, received 3 August 2005)</p>	<p>Mr Osborne was contacted by a Worsley environmental consultant via email on 1 June 2004 with a request for any information regarding recreational activities and sites in the broad study area (map provided to Mr Osborne indicating general study area). This contact was made prior to the Worsley proposal being publicly advertised for assessment by the EPA in 2004, and unfortunately the consultant was not in the position to divulge client or proposal details at that time.</p> <p>Mr Osborne indicated the study area was very large and referred the consultant to the walkgps (www.walkgps.com) website to provide an idea of the wide-spread of areas that offer good recreational bushwalking opportunities within the study area. This site was accessed in June 2004 and found to contain comprehensive information relating to bushwalking areas in the study area.</p>

## 6.2 ENVIRONMENTAL FACTORS ADDRESSED IN ERMP

### 6.2.1 Flora and vegetation

#### *Clearing of vegetation*

Item	Submission	Response
211	<p>WA already has the highest concentration of bauxite mining and Alumina Refining in the world. This is located in the sensitive Jarrah Forest and coastal environment. Bauxite mining has already destroyed 160 square kilometres of our unique Jarrah forest, and if the proposed expansion is approved, even more of the jarrah forest will be destroyed. Worsley will mine 240 ha of State Forest per year (a rise of 20% - which over the period of years that the alumina plant will operate, will not be sustainable.</p> <p>(Anonymous, received 30 June 2005)</p>	Noted.
212	<p>It will involve the clearing of huge acres of bushland communities of flora and fauna that we will never see the like of again - to recreate such communities are beyond the imagination or scope of our present human intelligence let alone capabilities.</p> <p>(Anonymous, received 3 August 2005)</p>	The submission raised no specific issue to which the proponent can respond. Worsley has demonstrated its commitment to sound environmental management within the ERMP and has also demonstrated successful operations of its bauxite-alumina project over more than 20 years since the project began. Worsley has a certified environmental management system and reports performance publicly in its Annual Environmental Report and Health, Safety, Environment and Community Report.
213	<p>Clearing of any native vegetation along the Darling Scarp is problematic, particularly when so much has already been cleared for alumina extraction.</p> <p>The Collie area contains species of Flora eg- grevillea rara, found only in this region. Some species of flora found in there are yet to be documented by scientific and environmental bodies. Many fauna species that are threatened or critically endangered inhabit the forest areas to be cleared for further mining. These species include white tailed black cockatoos, both Baudin and Carnaby types as well as chuditches and other marsupials. Further clearing of habitat can only push some of these species closer extinction.</p> <p>(Anonymous, received 3 August 2005)</p>	The submission indicates that mining will take place within the Collie area. This is not proposed for the expansion. Mining will expand from existing areas near Boddington as indicated in Figure 1.3 in the ERMP. Nevertheless the submission does raise relevant issues in relation to potential impacts on flora and fauna. These factors have been identified and addressed in the ERMP Volume 1, Chapter 3, sections 2 and 3. Commitments have been made to undertake extensive baseline survey prior to mining as is undertaken for existing mining areas.
214	<p>The 'indicative mine plan' in the ERMP (e.g.. Figure 5 of the Executive Summary) suggests mining will occur right up to boundary of the adjacent proposed Wandoo National Park: A buffer must be included to fully protect the conservation values of the future National Park.</p> <p>(David Osborne, 3 August 2005)</p>	See response to item 17.
215	<p>The summary of the "Existing environment" (page 52) states that Brookton and Central mining (and two other) mining areas are "located within and surrounded on most boundaries by State Forest". That is correct, but it needs to be also stated that "the Brookton mining area has a common boundary in part with the proposed Wandoo National Park" and the Central mining area is adjacent to the SW boundary of the Boyagarrig Conservation Park. Under "Environmental Management" of Vegetation and Flora on page 48, it also needs to be specified that there be "buffers between mining areas and National Parks and reserves", not just around areas of conservation significance within the mining area.</p> <p>(David Osborne, received 3 August 2005)</p>	Noted. See response to item 17.

Item	Submission	Response
216	<p>We are most concerned that Worsley Alumina Pty Ltd is considering expanding its mining operations into remnant bushland in the East Quindanning area which begins along the Williams to Pinjarra Road 5.8kms from the Harvey to Quindanning Road turn off.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>Worsley acknowledges that values placed on native vegetation by the submission. However the area in question is not included in the scope of the proposed Efficiency and Growth Project. The remnant vegetation area referred to by the submission, East Quindanning area which begins along the Williams to Pinjarra Road 5.8 km from the Harvey to Quindanning Road turn off, is within the already approved Primary Bauxite Area of Worsley's existing operations. The new mining envelope of East Quindanning does not include any remnant vegetation within the Quindanning Timber Reserve.</p>
217	<p>We bring the following points to your attention. The remnant areas [East Quindanning area which begins along the Williams to Pinjarra Road 5.8kms from the Harvey to Quindanning Road turn off] are:-</p> <ul style="list-style-type: none"> <li>• Free of invasive weeds with the exception of a small area previously used as a rubbish dump.</li> <li>• Contains diverse flora with all its layers of vegetation from the smallest plants to aged dead trees.</li> <li>• A key area in helping to maintain local flora and fauna diversity.</li> <li>• Valuable link to remnant corridors of flora and fauna.</li> <li>• Precious to future generations because of the above reasons.</li> </ul> <p>(Anonymous, received 3 August 2005)</p>	<p>See response to item 216 and general comments in section 3.</p>

## 6.2.2 Fauna

### Compliance with Scoping Document

Item	Submission	Response
218	<p>“Studies on fox predation, and documentation and an adequate review of previous fauna studies for the area not done.”</p> <p>“Inadequate on-ground assessment of threatened species, no survey work on SREs and no general fauna sampling to determine landscape scale patterns of distribution and abundance.”</p> <p>Assessment of potential impact of fragmentation and isolation of habitat and short range endemic communities not done.</p> <p>Commence baseline fauna study for comparison with on-going monitoring consisting of establishment of permanent trapping sites to allow population numbers and range to be measured over time not done.</p> <p>Assessment of the risk of individual deaths of threatened fauna not done.</p> <p>Assessment of the likelihood and risks of potential impacts on distribution and abundance of fauna, in particular of threatened/vulnerable fauna, priority species and local endemics through evaluation of the importance and role of habitat in proposed mining areas in local and regional context – “Minimally addressed for threatened species, but does not adequately indicate potential impacts on other fauna as required. The importance and role of habitat in proposed mining areas in local and regional context not done”</p> <p>Assessment of the impact of spread of dieback on fauna populations. – “Does not adequately address the impact of the spread of dieback on fauna populations”</p> <p>It is noted that under the heading of “Future Studies” (p17) in the scoping document that additional field survey work will be done. It is NOT adequate nor is it acceptable to indicate that this work might be done at some stage in the future. The whole point of a PUBLIC review of the information is to enable the public to assess all of available information and comment on the proposed impacts. Data from these proposed future surveys is required to enable an adequate assessment of the impacts. If only a fraction of the information is provided then proper process can not take place.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>Inconsistencies between scoping requirements and fauna report in ERMP</p> <p>The ERMP was produced after the desktop survey and preliminary spring survey had been carried out, and before future studies had been prepared. Briefly, catenary sampling was carried out along three transects in December 2004 and will take place at least annually, and probably more frequently, in the future. There are plans to move this sampling progressively across the study area to develop an understanding of patterns of distribution over the site. Quarterly bird surveys, also along the catenary transects, are proposed, as are studies into threatened species (black-cockatoos, Chuditch and other significant mammals). Bats were surveyed (echo-location and netting) in December 2004.</p> <p>The work actually carried out in 2004 and planned for the future has been discussed during three meetings with personnel from Worsley, CALM and the Department of Environment/EPA present. WA Museum staff were present at the third of these meetings (June 2005), at which the consultant presented the results of preliminary work. The field programme has been prepared in response to the discussions held at these meetings, and may differ slightly from the original scoping document. The scope presented in the ERMP probably does not reflect these discussions.</p> <p>The ERMP does make clear the commitment of Worsley to long-term fauna studies. The fauna will be progressively documented during landscape sampling that will yield information useful for mine planning. The question regarding the vertebrate fauna is not so much which species are present, but how they are distributed across the landscape. There are more difficult questions regarding how they are distributed across the landscape.</p>
219	<p>The proponent was clearly advised by the EPA what was required, this has not been done and should have happened BEFORE the ERMP was available for public comment. The responsibility to ensure this happened lies with the EPA as the statutory protector of the environment. On this account alone the ERMP should not be approved by the EPA. The appropriate survey work is required and when it is done and reported on the ERMP should again be released for public comment.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>See response to item 220 and general text of section 3.</p>



**Adequacy of faunal surveys**

Item	Submission	Response
220	<p>“The survey effort and coverage is not adequate and does not reflect the faunal diversity of the area” (GS pp. 10)</p> <p>Survey conforms to scale and nature of impact (GS pp12, Table 3)</p> <ul style="list-style-type: none"> <li>• Habitat degradation</li> <li>• size and scale</li> <li>• protected fauna</li> <li>• faunal assemblage significant</li> <li>• overall</li> </ul> <p>“requires a level 2 comprehensive survey”</p> <p>The adequacy of the description methods is average (GS pp 11)</p> <p>The low catch rate probably indicates an inappropriate trapping period, of at least the trapping should have been repeated – see comments on pp 15 where the consultant acknowledges the problem (GS pp 11, 13)</p> <p>Surveys over multiple years where a single years data are not adequate to assess the assemblage e.g for base line surveys (GS pp. 10, 12) – Not Done</p> <p>No survey effort demonstrated (GS pp 13) and no survey effort to assess; Species richness per biotope, Assemblage structure per biotope, rare and protected species, range restricted species, ecosystem values, coverage of the impacted area, seasonal and temporal variations, trap types, species-specific searches for conservation significance species, reptiles, mammals, fish, bats birds, amphibians, invertebrates</p> <p>Efficacy of sampling methods – trap types (GS pp 14)</p> <ul style="list-style-type: none"> <li>• Overall – Poor</li> <li>• Pit-traps, funnel traps and bat echolocation/mist nets – Not done</li> <li>• Cage traps and Elliott traps - Poor</li> </ul> <p>Comments based on</p> <p>PS= EPA (2002). Terrestrial Biological Surveys as an Element of Biodiversity Protection: Position Statement No. 3; and</p> <p>GS= EPA (2004). Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>Survey work undertaken is not based on a rigid acceptance and interpretation of the position and guidance statements prepared by the EPA. The Authority has made it clear in meetings that these are for advice and guidance only, and that many assessments, especially one of the scale and given the long timeframe of the project, need a tailored approach. With regard to the specific comments made, many do not take into account of further work that is planned, which is a result of the ERMP being produced before most work has taken place. Even if the ERMP had been delayed for six months or a year, however, many of the comments would still apply, as it will be years before some conditions are met if the EPA guidance statements are adhered to exactly.</p> <p>As noted by Dr Thompson, reptiles are of great value as bio-indicators for rehabilitation because they are sedentary and dependent on a range of environmental characteristics such as soil type, leaf-litter, vegetation structure and vegetation composition.</p>
221	<p>Poor Survey Data in regards to providing sufficient information to address biodiversity conservation and ecological function values at biotope level (PS pp 5)</p> <p>Data</p> <p>Poor Fauna data presented for each biotope (PS pp 5, 14; GS pp 15)</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>See response to item 220 above.</p>

Item	Submission	Response
222	<p>Adequacy of Staff</p> <p>Names and qualifications provided, no indication of experience (GS pp 11) (Dr Graham Thompson, 21 July 2005)</p>	<p>Fauna investigations were undertaken by a team of experienced zoologists under the supervision of Dr Mike Bamford who has many years field experience.</p>
223	<p>Compliance</p> <p>The assessment is not in accordance with GS No 56 (GS pp 9)</p> <p>Evidence of adherence to National and International Agreements, legislation and policy on biodiversity (PS pp 7) – It is very likely this could be a controlled action under the <i>EPBC 1999 Act</i> based on the possible presence of Carnaby's Cockatoo, Baudin's Cockatoo, Numbat and Chuditch in the area. A more comprehensive survey was expected with the possibility of these species being impacted on. (Dr Graham Thompson, 21 July 2005)</p>	<p>The proposal has been determined as a controlled action under the <i>EPBC Act</i> as indicated in Volume 1, Chapter 1, Section 1.2 of the ERMP.</p> <p>See general text in section 3.</p>
224	<p>Vouchered specimens not listed and animal ethics issues not considered (Dr Graham Thompson, 21 July 2005)</p>	<p>No fauna specimens were vouchered by the consulting ecologists. In accordance with 'Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56' (EPA 2004), the EPA would only expect fauna specimens to be vouchered when specimens:</p> <ul style="list-style-type: none"> <li>• are not readily identifiable as common</li> <li>• reflect taxonomic anomalies</li> <li>• are found to occur beyond a previously know range of a taxon.</li> </ul> <p>Specimens collected during the trapping program for the ERMP fauna study did not meet these criteria for vouchering. Consequently, no animal ethics issues are considered to be involved.</p>
225	<p>EPA (2004) Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56 requires that a comprehensive level 2 assessment be undertaken for this project. This has not been done.</p> <p>Recommendation</p> <p>That the EPA not approve this ERMP and requires the proponent to undertake the necessary terrestrial fauna survey work to meet both the requirements of Terrestrial Biological Surveys as an Element of Biodiversity Protection; Position Statement No. 3, Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56 and the requirements laid down in the scoping document. When this is down the report is released for public comment. (Dr Graham Thompson, 21 July 2005)</p>	<p>See general text in section 3.</p> <p>Recommendation to be addressed by the EPA.</p>
226	<p>Vol 1, Chapter 3 Fauna</p> <p>Pp 3-56 Comments under the heading of management measures to address loss of habitat provide no information to the public on the extent or the quality of work undertaken in any of these areas. A list of general statements is totally inadequate. (Dr Graham Thompson, 21 July 2005)</p>	<p>The list of dot points on p3-56 of the ERMP outline the existing management measures to address loss of habitat. An illustration of regional occurrence and abundance of fauna groups follows these points to illustrate no observed impact of regional abundance of vertebrates over the 20 years of mining operations to date.</p>

Item	Submission	Response
227	<p>Section 3.5 Monitoring and assessment (V 1, p3-59; V2, p3-3-4)</p> <p>Given that the proponent has not complied with the EPA directive in the scoping document in regard to fauna survey work required, one must seriously question the quality of baseline survey monitoring that has been undertaken for the fauna given that none of these data are made public. If they had such a comprehensive database then why was it not used in the Desktop Survey reported in the ERMP?</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	See general text in section 3.

### ***Adequacy of data analysis and write-up***

Item	Submission	Response
228	<p>Poor degree of rigour in data analysis and interpretation (GS pp 10)</p> <p>No data analysis undertaken at the habitat or biotope level, no appropriate diversity indices used and no adequate comparison with other regional datasets</p> <p>Poor analysis of rare, protected or species of conservation significance</p> <p>Sampling design poorly explained (GS pp 13, 14)</p> <p>No indication of limitation, no accuracy of survey limitation and no evidence authors are cognisant of trap bias. (GS pp14)</p> <p>“Why do the consultants not use FaunaBase, which is based upon WAM species lists” (GS pp 15)</p> <p>Context of survey (GS pp 16)</p> <ul style="list-style-type: none"> <li>• Survey objective clear and consistent with data collected – Poor</li> <li>• Adequate review of literature – “The consultant makes the point there is considerable data for the area from earlier surveys, if this is the case, then it was expected that a comprehensive assessment and table of these data would be presented and discussed in the report.”</li> <li>• Characteristic of fauna assemblages described – Poor</li> <li>• All aspect of faunal assemblages assessed in an ecological context – Not done</li> </ul> <p>“Eight habitat types are identified, but the link between faunal assemblages and these habitats is at best vague.”</p> <p>No biotopes assemblages assessed in a regional context</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	See response to item 220 and detailed response in section 3.

**Adequacy of impact assessment**

Item	Submission	Response
229	<p>Inadequate data to</p> <ul style="list-style-type: none"> <li>• assess impacts on the fauna</li> <li>• Discuss the significance of biodiversity impacted upon (PS pp 2)</li> <li>• take reasonable measures to avoid impacts on biodiversity (PS pp 5)</li> </ul> <p>where impacts are unavoidable, documentation on why impacts will not result in unacceptable fauna loss (PS pp 5) – Poor</p> <p>No clear evidence that the precautionary principle has been adopted (PS pp 5)</p> <p>Where a project or action is likely to affect biodiversity, the information gathered for EIA will enable the impacts to be determined to an acceptable level (PS pp 9) – Inadequate data to do this task properly</p> <p>No assessment biodiversity value considered at genetic, ecosystems level and ecological function values. (PS pp 12)</p> <p>Attempted assessment of biodiversity value for some species of conservation significance, poorly done (PS pp 12)</p> <p>Passing reference only to regional significance of faunal assemblages</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	See general text in section 3.
230	<p>The report has not been peer reviewed</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	Peer review was not requested by the EPA for this aspect. However Worsley is proposing that future biodiversity investigations undergo a peer review process. See general text in section 3.

### Assessment process and accountability

Item	Submission	Response
231	<p>Section 3.6 Proponent commitments</p> <p>Who ensures that the proponent undertakes the tasks and that the quality of the work is of an acceptable standard? The EPA in this instance has not ensured the proponent complied with the scoping document in the development of this ERMP. The EPA clearly cannot be relied upon to ensure an appropriate level of monitoring is undertaken and the results acted upon. Typically, baseline fauna surveys undertaken by mining companies are a waste of time as they do not collect adequate data to know whether differences from one survey to the next or between rehabilitated area and analogue sites are real or simply a function of sampling error and normal seasonal or year-to-year variations. There is no evidence offered in this ERMP to suggest that Worsley is any different to the vast majority of other mining companies.</p> <p>Recommendation:</p> <p>That the Minister, as a condition of the approval, requires that the Flora, Fauna and Forest Protection Plan (p3-60) be peer reviewed, and then the plans and peer review comments are made available for public comment before it is agreed to by the EPA. Then every 3 years Worsley publicly reports on the results of its monitoring program and what actions it has taken as a consequence.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>Matter to be addressed by the EPA.</p> <p>See general text of section 3.</p>

### 6.2.3 Landforms and soils

Item	Submission	Response
232	<p>The clearing, the movement of so much soil, the loss of the bauxite mineral, the blasting of caprock will lead to a general increase in degradation of the forest, woodland and bushland types throughout the region that will only lead to increasing stress upon remnant areas - eg more dieback, weeds to mention the more obvious issues. Regarding issues that have not been investigated properly such as forest immune systems and synchronicity, it will be too late to even investigate once the forest communities are destroyed. Obviously the precautionary principle would indicate that until one fully understands what is going on, best to leave well alone.</p> <p>Who knows properly the impacts of the blasting and destruction of caprock or what part it really plays in the whole ecological system. Caprock cannot be rebuilt once destroyed so it will be too late to understand it once it is gone. Again, obviously the precautionary principle would indicate that until one fully understands what is going on, best to leave well alone.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The submission raised no specific issue to which the proponent can respond. Worsley has demonstrated its commitment to sound environmental management within the ERMP and has also demonstrated successful operations of its bauxite-alumina project over more than 20 years since the project began. Worsley has a certified environmental management system and reports performance publicly in its Annual Environmental Report and Health, Safety, Environment and Community Report.</p>

## 6.2.4 Salinity

Item	Submission	Response
233	<p>Further clearing, especially in sensitive catchment areas and forest adjacent to catchment areas is a significant contributor to salinity in our waterways. Salinity remains Australia's greatest environmental threat.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The potential impacts on water resources are recognised as a significant environmental factor associated with the proposal. As a result, Worsley has undertaken a salinity risk assessment that identifies the potential impacts and areas (catchments) most sensitive to changes in salinity. The salinity risk assessment is presented in the ERMP in Volume 1, Chapter 3, Section 4, and has been peer reviewed by Dr Richard George of the Western Australian Department of Agriculture. The overall findings of the assessment, and concurrence from the peer review, is that the risk of salinity is low, due primarily to the greater depth to the water table in the low rainfall zone of the Darling Plateau.</p>

## 6.2.5 Water resources

Item	Submission	Response
234	<p>It is my understanding that measures to contain the waste, especially caustic from the refining process are inadequate and that leakage will inevitably occur some time in the future, probably when we have mined out by these overseas companies and have become destitutes existing on a barren wasteland. Who then, will be able to afford to treat the intensifying toxification of waterways and lands downstream? Of course this is all additional to the current toxification of air, land and water by current bauxite refining operations throughout the southwest and well documented by the people living in the vicinity of Yarloop.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The submission makes claims to which the proponent cannot respond. Worsley has demonstrated its commitment to sound environmental management within the ERMP and has also demonstrated successful operations of its bauxite-alumina project over more than 20 years since the project began. Worsley has a certified environmental management system and reports performance publicly in its Annual Environmental Report and Health, Safety, Environment and Community Report.</p> <p>No significant issues raised in this submission have occurred since Bauxite-Alumina Project operations began.</p>
235	<p>Clearing and mining in the Harris and Brunswick catchment areas and adjacent areas. Both of the above activities should be banned in any catchment area. Obviously it is too late to disband mining operations that already exist in these areas. It is possible, however, to prohibit any further expansion.</p> <p>Clearing for mining will, in the long term, adversely affect run off, contribute to salinity in both the Harris and Brunswick Rivers, and exacerbate the spread of dieback and the demise of aquatic flora and fauna species.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The submission indicates mining will take place within the Harris and Brunswick river catchments. This is not proposed for the expansion. The refinery is located within the Brunswick River catchment, and as such its operations are taken into account in the Brunswick Water Source Protection Plan developed pursuant to the <i>Country Areas Water Supply Act 1947</i>. The requirements of this protection plan are outlined in the Volume 1, Chapter 5, Section 4.2.3 of the ERMP.</p>
236	<p>The continued use of caustic soda in the production of alumina will be greatly increased once production is increased. I do not believe that no harmful by products of the Bayer Process get into the Augustus and Brunswick Rivers as a result of this. In summary, I believe the negative long term environmental impact of expanding Worsley's operations far outweigh the benefits. Access to and production of potable water sources in this area will be key environmental issues. It is totally unacceptable that any further mining takes place in any water catchment or adjacent area in Western Australia.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The operation of the refinery water management system is provided in Volume 1, Chapter 5, Section 4 of the ERMP. This system is specifically designed to protect the values of the Augustus River system. Monitoring of performance is reviewed and reported annually in the publicly available Annual Environmental Report.</p>

Item	Submission	Response
237	<p>There is no documentation in the environmental review relating to the water courses that run through my property as shown on map RF1.2500/Collie NW. This water supply is used for domestic, stock and irrigation.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The submission raises concern over potential contamination of farm water supplies. The Worsley Refinery is located in the headwaters of the Augustus River system on a water divide between the great Brunswick River and Collie River catchments. The refinery operates a contained water management system that separates all fresh water from potentially contaminated water. Any unlikely discharges from the refinery site would only occur downstream into the Augustus River system. No farming properties are located within many kilometres downstream of the refinery. The water course referred to in this submission is not located downstream of the refinery.</p>

### 6.2.6 Air emissions

Item	Submission	Response
238	<p>The alumina industry emits huge quantities of Greenhouse gas and other dangerous pollutants. These emissions are alleged to have caused health problems for workers and the community.</p> <p>(Anonymous, received 30 June 2005)</p>	<p>A comprehensive health risk assessment has been undertaken and summarised in the ERMP Volume, 1 Chapter 5, Section 2.9 (full report included in appendices).</p>
239	<p>Liquor Burner Emissions will be increased when the expansion project is completed and production is completed.</p> <p>Emissions from Worsley Alumina are already a contentious issue and a environmental problem and will continue to be in a future.</p> <p>Co2 emissions are always a serious concern. I am not reassured that Worsley Alumina will be adequately able to contain emissions from the Liquor Burner even with the best technology available.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>No changes to or increases in emissions are proposed due to the expansion. This is stated on p1-37 of the ERMP.</p> <p>Detailed assessment of the impact of changes in air emissions is provided in Volume 1, Chapter 5, Section 2 of the ERMP.</p> <p>Emission control systems on the liquor burner are designed to control emissions of VOCs and odour by 99% and 95% respectively. Performance testing to date indicate this performance is achievable. Worsley is required to report liquor burner emissions control performance testing to the DoE for verification.</p>
240	<p>I have no way of monitoring air and water pollution.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>In respect of monitoring air pollution, Worsley operates air quality monitoring stations on freehold land located to the west north west and south east of the refinery. The location of these stations are shown in Figure 5.1 of Volume 1 of the ERMP. A description of ambient monitoring results is given in Volume 1, Chapter 5, Section 2.3 and indicates all monitoring to be with National Environmental Protection Measure guidelines. This monitoring will continue following the proposed expansion, and will continue to be reported in Annual Environmental Reports.</p> <p>Worsley maintains a local groundwater and stream monitoring program. Results of this program are reported in the Annual Environmental Reports.</p>

## 6.2.7 Noise

Item	Submission	Response
241	Mining noise will also be a concern [for bushwalking] and that needs to be specifically noted. David Osborne, received 3 August 2005)	Worsley has established noise management standards and procedures for minimising noise emissions to ensure compliance with Noise Regulations (Volume 1, Section 6.4.4, pg 3-94 of the ERMP) and has committed to undertaking community consultation with regard to noise and vibration management (Proponent Commitment 10).
242	The summary of "Potential impacts" (page 56) needs to state that "Noise from the transport corridor and crushers will impact on at least three known walk areas". (David Osborne, received 3 August 2005)	Noted. Although the ERMP document will not itself be amended to clarify any points or add additional information suggested by Mr Osborne, it should be noted that the EPA will take into consideration all submissions received in its assessment of the proposal.
243	Commitment # 14 (Transport corridor, page 45) : Noise • Additional dot point is needed, to read as follows: "identification of potential impacts on recreational users of area." (David Osborne, received 3 August 2005)	See response to item 242 above.
244	"I own a (property) at Worsley were I have lived for twenty one years (21yrs)..." The changes in life style at the farm because of noise has been noticeable and I am concerned that the proposed Worsley Alumina Expansion is going to have even greater impact. Page 5.67 Figure 5.19 shows noise contours extremely close to my property which has not been on the map mentioned. At the present time noise from the Refinery can be heard in the house day and night. The increase of trains on the Collie Worsley line the Worsley Bunbury line and trucks on Gasteldo Road transporting acids, flocculants and lime will have a impact on community safety and noise levels. (Anonymous, received 3 August 2005)	Noise contours have been generated from the Environmental Noise Model run by SVT Engineering and take into account sound power levels from all expanded facilities at the refinery. Figure 5.19 of the ERMP, referred to in the submission, indicates that noise emissions from the refinery remain dominated by the overland conveyor system. The nearest noise sensitive premises is located some 8.5 km from the refinery. Noise modelling indicates that the expanded refinery will comply with requirements of the <i>Environmental Protection (Noise) Regulations 1997</i> at all known noise sensitive premises. Worsley undertakes periodic calibration of the Environmental Noise Model by establishing monitoring sites nearby the refinery for specified periods. Worsley is willing to undertake noise monitoring at nearby noise sensitive premises as part of this calibration work, or if required, to evaluate the level of operational noise apparent at sensitive premises.



## 6.2.8 Recreation

Item	Submission	Response
245	<p>The “Central” and “Brookton” areas that will be affected in part by the mining expansion have long been known to bushwalkers and have been growing in popularity for bushwalking activities in recent years. There are few formal recreational sites and trails within the proposed mining envelope, other than one or two picnic areas and a small section of the Bibbulmun Track. That may give a false impression that the areas are little used at present from a recreational point of view. Most of the existing recreational activity in the areas is informal and is therefore difficult to quantify. However, the areas do have high existing and future recreational potential for bushwalkers and others. Factors that have attracted bushwalkers and other nature-lovers, have in part been identified in Chapter 4, Section 7.2.2 of the ERMP. They include:</p> <ul style="list-style-type: none"> <li>i) proximity to Perth;</li> <li>ii) accessibility via quite good roads (including Metro and Wearne Roads); and</li> <li>iii) scenic and nature qualities.</li> </ul> <p>An additional attraction of the area is that, while being accessible, it also offers more scope for ‘off-track’ bushwalking for walkers who want variety and more solitude, away from the popular, heavily used, existing trails such as the Bibbulmun Track.</p> <p>The attached map [Figure 1 of Mr Osborne’s submission] shows a number of off-track ‘routes’ that are known by me to have been used in the area. These have been taken from the www.walkgps.com website and should not be considered comprehensive. There may be additional areas used by other bushwalkers. For the reasons above, existing, and potential future, walking ‘routes’ in the area are best defined in terms of likely areas of interest to walkers rather than as if they are specific “trails”. The absence of a specific existing “trail”, does not mean an area is of no interest to current and future bushwalkers. It is important that the Proponent is aware of this with regard to the Community and Stakeholder Consultation processes.</p> <p>(David Osborne, received 3 August 2005)</p>	<p>Worsley acknowledges that although there are few formal recreational sites/areas (e.g. sites typically identifiable with roadside signage and/or user facilities) within the Northern Jarrah Forest, the forest is widely used for informal recreational pursuits (Volume 1, Section 8.2.2, pg 3-110 of the ERMP) and recognises the difficulty in quantifying informal usage of the forested areas of the Northern Jarrah Forest.</p> <p>Worsley also acknowledges the usage of the forest for recreational pursuits is expected to increase due in part to the growing use of the walkgps website (Volume 1, Table 3.27, pg. 3-109 of the ERMP) and the growing popularity of eco-type physical activities (e.g. bushwalking and mountain bike riding) (Volume 1, Section 7.2.2, pg 4-26 of the ERMP).</p>

Item	Submission	Response
246	<p>The ERMP incorrectly states (e.g. Executive Summary page 23) that there are only “a small number of recreational sites within and near the proposed mining areas” and also that “most of the identified sites are in the area around the Bibbulmun Track”. Although it is correct that there are “few formal recreational areas” (page 29), there are in fact a significant number of valuable, informal recreational areas within the proposed mining areas, and they are not confined to the area around the Bibbulmun Track:</p> <p>At least seven (7) of the example walk routes shown on the attached map [Figure 1 of Mr Osborne’s submission] have potential to be significantly or substantially impacted by the mining expansion. They are in the following areas:</p> <ol style="list-style-type: none"> <li>1. Qualen Road (off Yarra Rd) area (mislabelled on ERMP Figure 3.17)</li> <li>2. Christmas Tree well area</li> <li>3. Upper Dale River area (Flint/north Gibbs) (mislabelled on ERMP Figure 3.17)</li> <li>4. Geddes Rock area</li> <li>5. Gibbs Rocks area</li> <li>6. Boyagarring Reserve (not shown on ERMP Figure 3.17)</li> <li>7. Bannister Hill area (not shown on ERMP Figure 3.17)</li> </ol> <p>The “Existing environment” summary needs to state that “there are few formal recreational areas, but there are a significant number of informal recreational areas, including known walk areas (as distinct from “walk trails”) within the proposed mining areas, and those are not confined to the area around the Bibbulmun Track.</p> <p>(David Osborne, received 3 August 2005)</p>	<p>See response to item 245.</p> <p>Although the ERMP document will not itself be amended to clarify any points or add additional information suggested by Mr Osborne, it should be noted that the EPA will take into consideration all submissions received in its assessment of the proposal.</p> <p>Worsley thanks Mr Osborne for the additional information he provided relating to the seven walks he listed in his submission.</p>
247	<p>The ERMP refers to existing “walk trails” in the area (e.g. in Vol.1, Chap. 3: 8.2.2 and Vol. 1, Chap. 4: 7.2.1). Most bushwalking in the area is ‘off-track’, not on defined “trails”. It therefore needs to be made clear in the ERMP that the absence of existing “trails” is not an indicator that an area is not currently used, or will not be used in future by bushwalkers. Aside from the small section of the existing Bibbulmun Track that may be affected at Gringer Creek, there are various informal/undefined walking areas and ‘routes’ which are used by bushwalkers in and around the mining expansion corridor. Those ‘routes’ are not existing foot-tracks or paths. To avoid misunderstanding by the Proponent and for the purposes of future Community Consultation, such ‘routes’ should therefore not be described as “walk trails” in the ERMP (Vol.1, Chap. 3: 8.2.2 and Vol. 1, Chap. 4: 7.2.1) but as “known walk areas”.</p> <p>(David Osborne, received 3 August 2005)</p> <p>Most off-track bushwalkers also find their own cross country ‘routes’ using map and compass (or GPS) navigation, which is part of the enjoyment and adventure of this increasingly popular recreational activity. Off-track bushwalking also does not create ‘tracks’ or ‘trails’ because the walkers seldom follow exactly the same route more than once (which in any event is very difficult to do, due to inherent navigation uncertainties with both GPS and compass). Off-track walkers therefore have a low impact on the environment, despite not being on existing trails. For example, off-track bushwalking has been popular in the Christmas Tree Well area for many years, but there is still no evidence of any ‘trails’ having developed as a result of that activity.</p> <p>(David Osborne, received 3 August 2005)</p>	<p>Worsley notes Mr Osborne’s comments regarding walk ‘trail/area’ terminology.</p> <p>The identification of known walk trails in the ERMP (Volume 1, Table 3.27, pg 3-109 and Figure 3.17, pg. 3-111) was not intended to indicate the full extent of bushwalking use of the forest and Worsley recognises the Northern Jarrah Forest is widely used for informal recreational pursuits.</p> <p>Worsley notes Mr Osborne’s comments regarding the low impact nature of off-track bushwalking.</p> <p>The intent of identifying the ‘walk trails’ in the ERMP and in Figure 3.17 (Volume 1, pg 3-111) was to identify known areas where bushwalking is undertaken and to highlight the wide-use of the forested areas for bushwalking; not to imply any existing disturbance in the identified areas in the form of walk trails/tracks.</p>

Item	Submission	Response
248	<p>Notable omissions in the ERMP are the walk areas at Bannister Hill and Boyagarring Reserve and those areas need to be added to Figure 3.17 and Table 3.27, etc. The 'Upper Dale' walking area is also more extensive than shown in the ERMP. Also two walk areas have been incorrectly identified on ERMP Figure 3.17 (e.g. the "Windsor Rocks Walk" label on ERMP Figure 3.17 should be corrected to read 'Qualen Road Walk', and the "Qualen Road Walk" label should be corrected to read 'Upper Dale River Walk'.)</p> <p>(David Osborne, received 3 August 2005)</p>	<p>Figure 3.17 (Volume 1, pg 3-111) in the ERMP was prepared using information that was obtained from the walkgps website in June/July 2004. The various sections of the ERMP were prepared over an 18 month period and at time of writing the European Heritage and Recreation section (Section 8, pg 3-108) walk areas 6 and 7 listed by Mr Osborne were not included on the walkgps website (sites added to website in September and October 2004).</p> <p>Worsley recognises that the walkgps website is continually updated. Worsley will ensure the involvement of bushwalking representatives in future mine planning stakeholder consultation to ensure the status of recreational use of the forest is accurately known.</p> <p>Mislabelling of walk trails in Figure 3.17 is noted.</p>

Item	Submission	Response
249	<ul style="list-style-type: none"> <li>• The potential for loss of recreational and visual amenity through encroachment of mining on areas of mature wandoo woodland also needs to be specifically noted in the ERMP [Qualen Rd area].</li> <li>• There is also potential for loss of recreational and visual amenity through encroachment of mining on mature wandoo woodland and laterite breakaways in the easternmost area [Christmas Tree Well area].</li> <li>• The indicative conveyor belt route passes through the centre of this area and will be a direct disturbance in terms of noise, loss of recreational and visual amenity, and likely loss of access. Some mature wandoo woodland occurs in this area and would be affected along the transport corridor [Upper Dale River area].</li> <li>• The mining operations would result in noise and loss of recreational and visual amenity which needs to be specifically noted in the ERMP, Table 3.27 (which mentions “direct disturbance” and “temporary loss of access”) [Upper Dale River area].</li> <li>• This southern area will be directly and substantially impacted by the extensive, indicative mine plan [Upper Dale River area].</li> <li>• Mining operations will result in direct noise and possibly visual disturbance (as noted on Table 3.27) [Geedes Rocks area].</li> <li>• Mining operations will result in direct noise, visual disturbance, and potential permanent loss of recreational and visual amenity if laterite breakaways are affected, which needs to be noted in the ERMP, Table 3.27 [Gibbs Rocks area].</li> <li>• The indicative conveyor belt route passes immediately to the east of this area and a crusher plant location is planned in that area. These will result not only in likely temporary loss of access (as noted on Table 3.27), but also disturbance in terms of noise and some loss of visual amenity, which needs to be noted in the ERMP, Table 3.27 [Gibbs Rocks area].</li> <li>• Mining operations will result in direct noise and probably visual disturbance [Boyagarring Reserve/Conservation Park]</li> <li>• The indicative mine plan encroaches substantially on the area. Mining operations will have a major impact on this walk area, resulting in noise, visual disturbance, and likely permanent loss of recreational and visual amenity and of recreational values, especially if laterite breakaways and mature wandoo woodlands are affected, which should be specifically noted in the ERMP, Table 3.27 [Bannister Hill area].</li> <li>• A crusher plant location is planned within the walk area, and the indicative conveyor belt route passes through the area. These will result in major direct disturbances in terms of noise, loss of recreational and visual amenity, and likely loss of access. Some beautiful wandoo woodland occurs in this area and would be affected along the transport corridor [Bannister Hill area].</li> </ul> <p>(David Osborne, received 3 August 2005)</p>	<p>Worsley notes Mr Osborne’s comments relating to potential impacts on known walk areas and although the ERMP document will not itself be amended to clarify any points or add additional information suggested by Mr Osborne, it should be noted that the EPA will take into consideration all submissions received in its assessment of the proposal.</p> <p>Noise impacts: Worsley has established noise management standards and procedures for minimising noise emissions to ensure compliance with Noise Regulations (Volume 1, Section 6.4.4, pg 3-94 of the ERMP) and has committed to undertaking community consultation with regard to noise and vibration management (Proponent Commitment 10).</p> <p>Access / recreational area impacts: Worsley acknowledges the ‘network of forestry tracks in the Northern Jarrah Forest has moderate public usage for accessing activities’ and that mining operations may require temporary closure of some forestry tracks, possibly prohibiting access to some sites used for recreational pursuits (Volume 1, Section 8.3.2, pg 3-113 of the ERMP).</p> <p>Worsley will undertake comprehensive stakeholder consultation during the mine planning process to identify and mitigate potential impacts, such as public access to forest areas (see detailed response in Section 3.3). In addition, the CALM-Worsley Working Arrangements will continue to provide the mechanism for managing access to State Forest and forest pursuits during the periods between site preparation and rehabilitation (Volume 1, Section 8.3.2, pg 3-113 of the ERMP).</p> <p>Visual amenity impacts: Many of the features of the natural landscape that Mr Osborne identified as attracting bushwalkers to the region are included in the mining exclusion criteria that Worsley have committed to.</p>

Item	Submission	Response
250	<p>The ERMP (Table 3.27) notes that the “walk trail [Christmas Tree Well] will not be directly disturbed”. That appears to be incorrect. In fact the eastern area of the walk area extends into the edge of the new mining area. The plan indicates a bauxite resource in that area. The ERMP statement that “an adequate vegetative buffer should ensure mining operations are not visible” may therefore not be valid. Direct disturbance appears likely in that area, which should be noted on Table 3.27.</p> <p>(David Osborne, 3 August 2005)</p>	<p>Using the Christmas Tree Well walk trail location information available to Worsley, the eastern boundary of the walk trail appears to extend into the boundary of the Brookton mining envelope but not over the indicative mine plan. Based on this mapping the walk trail is not anticipated to be directly disturbed, however, Worsley does acknowledge that the delineation of the “precise areas to be cleared [for mining] cannot be made until after close spaced exploration drilling and detailed mine planning is undertaken” (Volume 1, Section 2.4.2, pg 3-33 of the ERMP) and direct disturbance of the walk may eventuate.</p>
251	<p>Vehicle access to the area [Upper Dale River area] relies on Metro Road remaining open to the public which should be specifically noted in the ERMP, Table 3.27.</p> <p>Vehicle access to the area [Geddes Rocks area] relies on Metro, McCallum and Watershed Roads remaining open to the public which needs to be noted in the ERMP, Table 3.27.</p> <p>Vehicle access to the area [Gibbs Rocks area] relies on Wearne and Pike Roads, and/or Metro Road, remaining open to the public which needs to be noted in the ERMP, Table 3.27.</p> <p>(David Osborne, 3 August 2005)</p>	<p>Worsley acknowledges the ‘network of forestry tracks in the Northern Jarrah Forest has moderate public usage for accessing activities such as bushwalking, camping and trail bike riding’ and that mining operations may require temporary closure of some forestry tracks, possibly prohibiting access to some sites used for recreational pursuits (Volume 1, Section 8.3.2, pg 3-113 of the ERMP).</p> <p>Worsley will undertake comprehensive stakeholder consultation during the mine planning process to identify and mitigate potential impacts, such as public access to forest areas (see detailed response in Section 3.5). In addition, the CALM-Worsley Working Arrangements will continue to provide the mechanism for managing access to State Forest and forest pursuits during the periods between site preparation and rehabilitation (Volume 1, Section 8.3.2, pg 3-113 of the ERMP).</p>
252	<p>The ERMP does not give any indication of the timeframe that the Proponent implies by “short term” loss of public access. If vehicle access is blocked along existing public roads within the mining expansion envelope, it will have the adverse impact of encouraging illegal access from the west (from Albany Highway) via existing forestry tracks through the ‘Jarrah Die-back Disease Risk Areas’.</p> <p>Mining operations in the mining expansion envelope have a potential life of 30-35 years. The ERMP states (e.g. Executive Summary, bottom of page 23, under European Heritage and Recreation) that:</p> <p>“In the short term, access to areas frequented for recreational pursuits will be prohibited (in some instances), or require access by alternative routes, which may be a minor inconvenience. Access will be re-established when mining operations cease.”</p> <p>At least three known walk areas in the Central mining area (i.e. Upper Dale River, Geddes Rock, Gibbs Rocks) rely on vehicle access variously via Wearne, Pike, McCallum, part of Watershed, and/or Metro Roads. If any of those roads are blocked to public access within the mining expansion area, then much of the Central area could become effectively inaccessible to the public for bushwalking and other recreational purposes, for an unspecified period. That would be more than a “minor inconvenience” to bushwalkers.</p> <p>(David Osborne, received 3 August 2005)</p>	<p>See detailed response in Section 3.</p>

Item	Submission	Response
253	<p>The ERMP Executive Summary (page 29 and elsewhere) needs to more accurately state that:</p> <ul style="list-style-type: none"> <li>the proposed transport corridor passes through the middle of the Upper Dale River walk area (i.e. not just “close” to it).</li> </ul> <p>The ERMP (page 29 and elsewhere) also needs to add that:</p> <ul style="list-style-type: none"> <li>the proposed transport corridor also passes through the Bannister Hill walk area;</li> <li>crusher plant locations are proposed within the Bannister Hill area and close to the Gibbs Rocks area.</li> </ul> <p>The summary of the “Existing environment” (page 56) states that “No recreational areas are known to exist close to the proposed bauxite transport corridor”. That statement is incorrect. It needs to be stated that “the proposed transport corridor passes close to, and in at least two instances through known walk areas. Crusher plant locations are proposed close to or within two walk areas.”</p> <p>(David Osborne, received 3 August 2005)</p>	<p>The bauxite transport corridor route delineated in Figure 1.3 (Volume 1, pg 1-6 of the ERMP) is indicative only and the “exact alignment for each section [of the corridor] will be selected as part of the detailed design and mine planning process” (Volume 1, Section 1.2, pg 4-1 of the ERMP) which will also include extensive stakeholder consultation. The ERMP does acknowledge that the proposed bauxite transport corridor “may traverse or come close to known walk trails” (Section 9.3.1, pg 4-27 of the ERMP).</p> <p>Although the ERMP document will not itself be amended to clarify any points or add additional information suggested by Mr Osborne, it should be noted that the EPA will take into consideration all submissions received in its assessment of the proposal.</p>
254	<p>Commitment # 11 (Project Wide, page 45) : European Heritage</p> <ul style="list-style-type: none"> <li>Additional dot point is needed, to read as follows: “continued public access to recreational areas via suitable existing roads, wherever safely possible during mining operations”.</li> </ul> <p>Commitment # 13 (Transport corridor, page 45) : Operation</p> <ul style="list-style-type: none"> <li>Additional dot point is needed, to read as follows: “measures to maintain public access to recreational areas via suitable existing roads, wherever safely possible during mining operations”.</li> </ul> <p>The summary of “Potential impacts” (page 52) needs to include the following :</p> <ul style="list-style-type: none"> <li>Impacts “on known walk areas” (not only on existing “walk trails”);</li> <li>“Mining operations may potentially alter the long-term intrinsic value to users of a particular area”.</li> <li>“Potential for loss of public access by road to known walk areas, for potentially long periods”.</li> </ul> <p>The summary of “Environmental management” (page 52) needs to also state the following :</p> <ul style="list-style-type: none"> <li>“Avoidance wherever possible of damage or loss of natural features (e.g. laterite breakaways and mature wandoo woodlands) of significant scenic and recreational amenity value”</li> </ul> <p>(David Osborne, received 3 August 2005)</p>	<p>Noted.</p> <p>Although the ERMP document will not itself be amended to clarify any points or add additional information suggested by Mr Osborne, it should be noted that the EPA will take into consideration all submissions received in its assessment of the proposal.</p>

Item	Submission	Response
255	<p>We have enjoyed walking the tracks in the area [East Quindanning area which begins along the Williams to Pinjarra Road 5.8kms from the Harvey to Quindanning Road turn off] and realise that if mining operations expand into this bushland it will be closed to public use. We bring the following points to your attention. The remnant areas are the only pieces of natural bushland currently available for the public to walk and enjoy.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>The area referred to by the submission, East Quindanning area which begins along the Williams to Pinjarra Road 5.8 km from the Harvey to Quindanning Road turn off, is within the already approved Primary Bauxite Area of Worsley's existing operations. The new mining envelope of East Quindanning does not include any remnant vegetation within the Quindanning Timber Reserve.</p> <p>It is considered that one of the concerns raised by the submission relates to having access to areas to enable the public to enjoy pursuits in forested areas. Worsley acknowledges that mining operations place restrictions on public access to maintain public safety in accordance with Mines Safety Regulations and undertakes to consult with CALM, through the Ten Year Mine Planning review with EMLG to maximise areas that are open to the public and for recreational activities.</p>

### 6.2.9 Visual amenity

Item	Submission	Response
256	<p>Some of the intrinsic "scenic and nature" qualities that attract bushwalkers to the area include the patches of mature wandoo woodlands, laterite breakaways, occasional stream gullies, scattered granite outcrops, and some scenic views. The Executive Summary of the ERMP (page 30, under Visual Amenity) correctly recognizes that "Within the project area, the forested areas of the Brookton and Central mining envelopes could be perceived as having a high scenic amenity value as they contain natural features of the environment in a relatively undisturbed condition and allow for visitor and recreational use."</p> <p>(David Osborne, 3 August 2005)</p>	<p>Many of the features of the natural landscape that Mr Osborne identifies as intrinsic scenic and nature qualities that attract bushwalkers to the region are included in the mining exclusion criteria that Worsley have committed to.</p>
257	<p>The summary of the "Environmental outcome" (page 52) states that "the impact on visual amenity is temporary...". This is an over-simplification. It needs to be stated that "there may be "some long-term and effectively permanent loss of visual amenity in relation to some intrinsic scenic values in known walk areas" (especially if laterite breakaways and mature wandoo woodlands are affected).</p> <p>(David Osborne, received 3 August 2005)</p>	<p>See response to item 256.</p>

### 6.2.10 Traffic (road and rail)

Item	Submission	Response
258	<p>The increase of trains on the Collie Worsley line the Worsley Bunbury line and trucks on Gasteldo Road transporting acids, flocculants and lime will have a impact on community safety and noise levels</p> <p>(Anonymous, 3 August 2005)</p>	<p>Refer to response to item 134.</p>

## 6.2.11 Rehabilitation

Item	Submission	Response
259	<p>Comments on 'A Review of the Rehabilitation at Worsley Alumina's Boddington Bauxite Mine'</p> <p>What is described by Worsley as best practice in rehabilitation falls a fair way short of what is described as best practice in the recent literature. The proponent has not recognised and discussed information in the recent literature on best practice measures of rehabilitation success.</p> <p>Recreating the soils and vegetation communities in a rehabilitated area to a condition similar to that before the disturbance are highly desirable and even essential outcomes. However, the ultimate objective for any rehabilitated area that was essentially an undisturbed area before the mining, must surely be the recreation of a near-natural, self-sustaining functional ecosystem similar to that which existed prior to the disturbance. The presence of appropriate soils and a vegetation community does NOT ensure that the rehabilitated area will become a near-natural, self-sustaining functional ecosystem similar to that which existed prior to the disturbance. It is not adequate to presume that if the appropriate soils and vegetation are provided, then the microbial organisms, invertebrates and vertebrates will recolonise the area. For example, it is not adequate to say (p3-61) that Worsley will progressive recreate the original fauna habitat values. What needs to be demonstrated is the creation of near original functional ecosystems which includes the vertebrate fauna. In this regard, I thought that a mining company of Worsley Alumina status would have set its rehabilitation goals to achieving the highest standards of best practice.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>Worsley will continue its research and improvement program in order to continuously improve performance of rehabilitation. It should be noted that since mining operations began, the rehabilitation prescription has altered significantly, from the use of exotic tree species to use of local provenance species as a result of research programs that have improved understanding of mechanisms for establishment of local species. As the rehabilitation review states, Worsley's rehabilitation program is on a trajectory toward restoring forest values.</p>
260	<p>Generally, the full suite of small vertebrates are the last to colonise a rehabilitated area, and reptiles in particular, are the last of the small vertebrates (I have a paper in press that documents this, and would be more than happy to send to the proponent). Small vertebrates, in particular reptiles, are therefore one of the best available taxa to measure rehabilitation success, and should be used in this circumstance, particularly as Worsley are claiming to be utilising best practice.</p> <p>The presence of invertebrate or small vertebrate species in a rehabilitated area by itself is not an adequate measure of rehabilitation success (see Table 2, p5-1). What is necessary is to demonstrate that the small vertebrate assemblage (which is a function of both species richness and relative abundance) closely mimics that in the undisturbed area, thereby demonstrating the achievement of the ultimate objective, the creation of a near-natural, self-sustaining, functional ecosystems similar to that which existed before the disturbance. It is appreciated that it can take many decades even when the appropriate soils, vegetation, nutrients and microbial processes are in place for small vertebrate assemblages to establish themselves. However, the use of small vertebrate assemblage as the measuring stick of success is superior to measurements of plant communities, soil, nutrients, etc because they are the necessary prerequisites for the establishment of near-natural small vertebrate faunal assemblages in rehabilitated areas.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>Noted. The paper referred to in the submission has been requested and supplied by Dr Thompson.</p>



Item	Submission	Response
261	<p>We have developed a mine site rehabilitation index that quantitatively describes the extent to which a rehabilitated area matches that in an undisturbed analogue site using the reptile assemblage. I'm happy to send the proponent the documentation if they email me.</p> <p>Recommendation</p> <p>That the EPA sets as the primary objective for rehabilitated areas that were previously undisturbed habitat, that the proponent demonstrates that sufficient progress that without further management intervention that nature will take its course to develop near-natural, self-sustaining functional ecosystems similar to that which existed before the disturbance before the proponent is released from its environmental obligations and its bonds are returned.</p> <p>(Dr Graham Thompson, 21 July 2005)</p>	<p>Matter to be addressed by the EPA.</p>
262	<p>Rehabilitating minesites is not a solution to the destruction of native vegetation in the first place, even if it has a history of logging and mining. The rehabilitated site will never be anything other than a poor substitute for what existed before clearing and mining.</p> <p>I am also deeply disturbed to learn that Worsley Alumina uses a super phosphate to fertilize rehabilitated areas. This is grossly irresponsible given this chemical's association with the salinisation of the /Collie River during the 1960's and 70's.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>Worsley has obligations to rehabilitate areas disturbed by operations. Worsley also undertakes research aimed at optimising the performance of rehabilitation and to meet the stated objective of establishing a sustainable system compatible with surrounding forested areas.</p> <p>Fertiliser trials continue with the University of Western Australia to optimise use of fertiliser to facilitate rehabilitation performance. The use of fertilisers is an integral part of Worsley's rehabilitation prescription developed in consultation with CALM.</p>
263	<p>The Executive Summary however also states (page 23, under European Heritage and Recreation, bottom para..) that "recreational values will be re-established in any areas where mining activities will disturb those values" and "the visual impact of mining operations will not be permanent" (page 24 under 'Visual Amenity'). Those unqualified statements promote a misleading notion that the original values of an area currently enjoyed by bushwalkers can be severely impacted or destroyed and then reconstructed for their resumed enjoyment in the future.</p> <p>It is clear that post-mining 'rehabilitation' of the landscape cannot duplicate the original, intrinsic qualities of a particular area, even in the long term. The original value of the recreational amenity to bushwalkers may be largely lost forever. That potential outcome is inconsistent with the EPA objective of ensuring that "existing and planned recreational uses are not compromised" (refer Executive Summary, page 52).</p> <p>In view of the above, close consultation with the stakeholders in advance of finalizing mining plans will be needed to avoid wherever possible the removal of particular natural features (including laterite breakaways and wandoo woodlands) which provide the intrinsic character in areas that attract walkers.</p> <p>(David Osborne, received 3 August 2005)</p>	<p>Many of the features of the natural landscape that Mr Osborne identifies as intrinsic scenic and nature qualities that attract bushwalkers to the region are included in the mining exclusion criteria that Worsley have committed to.</p> <p>Worsley's objective for rehabilitation of forest areas is to re-establish native vegetation that, amongst others, restores visual amenity and specific goals for rehabilitation include the maintenance of recreation and landscape values. Worsley's rehabilitation prescription for State Forest is continually reviewed by CALM and Worsley, and CALM conducts regular audits of Worsley's rehabilitation. Identified shortcomings in rehabilitation outcomes are addressed through the Environmental Management System, ensuring that sufficient resources are directed towards their improvement (Volume 2, Section 4, pg 3-13 of the ERMP).</p> <p>Worsley's rehabilitation program was subject to an independent review, which concluded Worsley's rehabilitation program does represent industry best practice and that there is no evidence to suggest Worsley's rehabilitation is dysfunctional (Volume 1, Section 2.4.2, pg 3-38 of the ERMP).</p>

Item	Submission	Response
264	<p>We also make these points:-</p> <ul style="list-style-type: none"> <li>• More people are becoming aware of the importance of retaining what natural bushland remains.</li> <li>• We feel these areas will lose their significance if even small areas of mining are permitted within them.</li> <li>• Areas revegetated when mining has ceased can never replicate the complexity and diversity of species and their ecology which have evolved over millions of years.</li> <li>• We believe our community has a right to know about and enjoy our remaining bushland heritage. Once gone it is gone forever.</li> </ul> <p>(Anonymous, received 3 August 2005)</p>	See response to item 263.

### 6.2.12 Use of resources

Item	Submission	Response
265	<p>This industry uses massive amounts of energy and water. This is of concern, when energy needs to be conserved and there is a critical shortage of water.</p> <p>(Anonymous, 30 June 2005)</p>	<p>Worsley is ranked as one of the most energy efficient refineries in the world, as indicated in Volume 1, Chapter 2, Section 4.4.3 of the ERMP. Similarly, water use efficiency has improved significantly at the refinery as indicated by almost halving the use of water per unit of alumina refined in recent years (Volume 1, Chapter 5, Section 4.4.4).</p>

### 6.2.13 Impact on organic farming

Item	Submission	Response																				
266	<p>“I own a [property] at Worsley were I have lived for twenty one years (21yrs) this property is farmed as organic and is certified with the National Association of Sustainable Agriculture (NASAA) my certification number is....”</p> <p>On this property there are twenty six (26) Dexter cattle which are managed as a commercial herd and registered stud also a thousand (1000) apple trees. The fruit from these trees is sold to organic wholesale and retain outlets. Any contamination found in fruit or meat produce on my property would render it worthless and my certification membership cancelled there for destroying my status as a organic grower after many years of hard work developing a sustainable environment.</p> <p>(Anonymous, received 3 August 2005)</p>	<p>Emissions modelling, prediction of ground level concentration of substances and the health risk assessment undertaken for the expansion has been on the basis of a conservative assessment of the impact on public health.</p> <p>Worsley understands that the predominant requirement for attaining and maintaining organic accreditation is to prevent residues in or on produce that are due to farm inputs (Australian Certified Organic 2003), and minimise residues that may be due to ambient conditions. While the assessment of air emissions has been on the basis of public health, Table 5.11 in the ERMP provides a comparison of the maximum ground level concentrations of substances for existing refinery operations, and those predicted for expanded operations. Substances that may be considered to potentially impact on residue levels of produce could be heavy metals and persistent compounds such as dioxins/furans, and possibly particulate matter.</p> <p>Analysis of the predicted ground level concentrations of persistent substances emitted from the refinery shown in Table 5.11 indicates only very small increases in the concentration of metals, persistent compounds and particulate matter. A summary of these changes is shown below. It is considered unlikely that changes in emissions due to the proposed expansion are likely to result in any changes in residues in or on farm produce. It should also be noted that the ground level concentrations shown in the following table represent maximum values from within an approximate 15 x 15 km grid surrounding the refinery. The predicted ground level concentrations at the organic farming property may be less then those provided in the table.</p> <table border="1" data-bbox="1099 821 1845 1228"> <thead> <tr> <th>Substance</th> <th>Maximum annual average ground level concentration for existing operations (ug/m<sup>3</sup>)</th> <th>Maximum annual average ground level concentration for expanded operations (ug/m<sup>3</sup>)</th> <th>Increase in annual average ground level concentration (ug/m<sup>3</sup>)</th> </tr> </thead> <tbody> <tr> <td>Arsenic</td> <td>2x10<sup>-5</sup></td> <td>2.5x10<sup>-5</sup></td> <td>5x10<sup>-6</sup></td> </tr> <tr> <td>Dioxins and Furans</td> <td>6.2x10<sup>-11</sup></td> <td>7.3x10<sup>-11</sup></td> <td>1.1x10<sup>-11</sup></td> </tr> <tr> <td>Mercury</td> <td>5.1x10<sup>-4</sup></td> <td>6.9x10<sup>-4</sup></td> <td>1.8x10<sup>-4</sup></td> </tr> <tr> <td>Particulate matter (&lt;2.5 um)</td> <td>0.062</td> <td>0.064</td> <td>0.002</td> </tr> </tbody> </table>	Substance	Maximum annual average ground level concentration for existing operations (ug/m <sup>3</sup> )	Maximum annual average ground level concentration for expanded operations (ug/m <sup>3</sup> )	Increase in annual average ground level concentration (ug/m <sup>3</sup> )	Arsenic	2x10 <sup>-5</sup>	2.5x10 <sup>-5</sup>	5x10 <sup>-6</sup>	Dioxins and Furans	6.2x10 <sup>-11</sup>	7.3x10 <sup>-11</sup>	1.1x10 <sup>-11</sup>	Mercury	5.1x10 <sup>-4</sup>	6.9x10 <sup>-4</sup>	1.8x10 <sup>-4</sup>	Particulate matter (<2.5 um)	0.062	0.064	0.002
Substance	Maximum annual average ground level concentration for existing operations (ug/m <sup>3</sup> )	Maximum annual average ground level concentration for expanded operations (ug/m <sup>3</sup> )	Increase in annual average ground level concentration (ug/m <sup>3</sup> )																			
Arsenic	2x10 <sup>-5</sup>	2.5x10 <sup>-5</sup>	5x10 <sup>-6</sup>																			
Dioxins and Furans	6.2x10 <sup>-11</sup>	7.3x10 <sup>-11</sup>	1.1x10 <sup>-11</sup>																			
Mercury	5.1x10 <sup>-4</sup>	6.9x10 <sup>-4</sup>	1.8x10 <sup>-4</sup>																			
Particulate matter (<2.5 um)	0.062	0.064	0.002																			

## 7. REFERENCES

- Australian Certified Organic, 2003, *Organic Standard*, Version 6, August 2003.
- Bamford, M. J., Wilcox, J. A. and Davis, R. A., 2004, *Worsley Alumina Extension area: northern mining envelopes – Preliminary Fauna Assessment*, Unpublished report prepared for Worsley Alumina Pty Ltd, December 2004.
- Bennett Environmental Consulting, 2004, *Vegetation and Flora Survey of Mining Lease ML258SA*, Unpublished report prepared for Worsley Alumina Pty Ltd, December 2004.
- Cardillo, M. and Bromham, L., 2001, *Body size and risk of extinction in Australian mammals*, in *Conservation Biology* 2001, 15: 1435-1440.
- Christidis, L and Boles, W. E., 1994, *The Taxonomy and Species of Birds of Australia and its Territories*, Royal Australasian Ornithologists Union, Monograph 2.
- EA & PAE 2005, *Worsley Alumina Refinery – Proposed expansion to 4.4 Mtpa – Air Dispersion Modelling Verification Technical Report*. Environmental Alliances (EA) and Pacific Air and Environment (PAE), March 2005.
- EA & PAE 2005, *Worsley Alumina Refinery – Proposed expansion to 4.4 Mtpa – Air Dispersion Modelling*. Environmental Alliances (EA) and Pacific Air and Environment (PAE), April 2005.
- Environmental Protection Authority (EPA), 2002, *Terrestrial Biological Surveys as an Element of Biodiversity Protection*, Position Statement No. 3, March 2002.
- Environmental Protection Authority (EPA), 2002, *Guidance for the Assessment of Environmental Factors, Guidance Statement for the Assessment of Odour Impacts for New Developments*, Guidance Statement No. 47, March 2002.
- Environmental Protection Authority (EPA), 2004, *Guidance for the Assessment of Environmental Factors, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, Guidance Statement No. 56, June 2004.
- Environmental Protection Authority (EPA), 2005, *Bluewaters Power Station, Griffin Energy Pty Ltd, Report and Recommendations of the Environmental Protection Authority*, Environmental Protection Authority, January 2005.
- Jiang, J., Coffey, P. and Toohey, B., 2005, *Odour Intensity Measurement For Wastewater And Alumina Industries*, 17<sup>th</sup> International Clean Air and Environment Conference, 3-6 May, Hobart Tasmania, 2005.
- Keighery, B., 1994. *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of Western Australia.
- Pitt, D., 2003, *Letters to the Editor*, Clean Air and Environmental Quality, Volume 27 No. 4, November 2003.

Strategen, 2004, *Worsley Bauxite – Alumina Operation, Efficiency and Growth Increase to 4.4 Mtpa Alumina Production – Scoping Document Final*, Prepared for Worsley Alumina Pty Ltd, November 2004.

URS, 2004, *A Review of Rehabilitation at Worsley Alumina’s Boddington Bauxite Mine*. URS Australia Pty. Ltd., October 2004.

WA Museum, 2001, *Checklist for the Vertebrates of Western Australia*, Records of the WA Museum, Supplement No. 63.

Welker Environmental Consultancy (WEC), 2003, *Proposed Liquor Burner Emissions Control System – Works Approval Application*, Prepared for Worsley Alumina Pty. Ltd., March 2003.

Welker Environmental Consultancy (WEC), 2002, *Assessment of Odour from the Liquor Burner Emissions – Worsley Alumina Refinery*, Prepared for Worsley Alumina Pty. Ltd., August 2002.

## 8. ABBREVIATIONS

AER	Annual Environmental Report
Agreement Act	Alumina Refinery (Worsley) Agreement Act 1973
AQD	Department of Environment's Air Quality Division
BP	Best practice
BRDA	Bauxite residue disposal area
CALM	Department for Conservation and Land Management
CEMS	Continuous emissions monitoring system
CER	Consultative environmental review
CLC	Community liaison committee
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> -e	Carbon dioxide equivalent
CrVI	Chromium VI
CRW	Critical weight range
CSIRO	Commonwealth Scientific & Industrial Research Organisation
dB	Decibel
DoE	Department of Environment
DOCEP	Department of Consumer and Employment Protection
DOH	Department of Health
EAR	Environmental assessment report
EIA	Environmental impact assessment
EMLG	Environmental management liaison group
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986</i>

---

EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERMP	Environmental review and management program
EWR	Environmental water requirement
FESA	Fire and Emergency Services Authority
FGD	Flue gas desulphurisation
FWL	Freshwater lake
GJ	Gigajoule
GL	Gigalitre
GL/a	Gigalitre per annum
GLC	Ground level concentration
GPS	Global positioning system
g/s	Grams per second
ha	Hectare
hr	Hour
HRA	Health risk assessment
km	Kilometre
LBF	Liquor burner facility
LGA	Local Government Authority
m	Metre
Mtpa	Million tones per annum
MW	Megawatt
NASAA	National Association for Sustainable Agriculture Australia
NEPM	National environmental protection measure
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Oxides of nitrogen
NPI	National pollutant inventory

---

NSW EPA	New South Wales Environmental Protection Authority
OU	Odour unit
PAH	Polycyclic aromatic hydrocarbons
PM <sub>10</sub>	Particles smaller than 10µm in aerodynamic diameter
PM <sub>2.5</sub>	Particles smaller than 2.5µm in aerodynamic diameter
ppm	Parts per million
PRTR	Peel Region Tourist Railway
RCL	Refinery catchment lake
RDA	Residue disposal area
RHC	Robust highest concentration
RHF	Rail Heritage Foundation
RIWI Act	<i>Rights in Water Irrigation Act 1914</i>
RTO	Regenerative thermal oxidizer
TEOM	Tapered element oscillating microbalance
tpa	Tonnes per annum
SO <sub>2</sub>	Sulphur dioxide
STP	Standard temperature & pressure
USEPA	United States Environmental Protection Authority
µg	Micro gram
VOC	Volatile organic compound
WAM	Western Australian Museum
WAPL	Worsley Alumina Pty Ltd
W/m	Watts per metre