

**Marandoo to Great Northern Highway,
east-west link road across Karijini National Park**

Ashburton Shire Council

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
Bulletin 805
January 1996**

KSA- 12/11

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's report.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the contents of the assessment report or recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of \$10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the \$10 fee) must reach the Minister's office no later than 5.00 pm on 26 January 1996.

Environmental Impact Assessment Process Timelines

Date	Timeline commences from receipt of full details of proposal from proponent for public review	Time (weeks)
28/8/95	Proponent document released for public comment	4
25/9/95	Public comment period closed	
6/10/95	Issues raised during public comment period summarised by EPA and forwarded to the proponent	2
20/10/95	Proponent response to the issues raised received	2
12/1/96	EPA reported to the Minister for the Environment	11

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Summary and recommendations

This report and recommendations provides the Environmental Protection Authority's advice to the Minister for the Environment on the environmental acceptability of the proposal to construct an east-west link road from Marandoo to Great Northern Highway, across Karijini National Park, within the Pilbara region.

The Ashburton Shire Council is the proponent and Main Roads Western Australia are the project managers on behalf of the Shire.

The Environmental Protection Authority identified the main environmental issues requiring detailed consideration as:

- alternative routes and their impacts on the national park;
- source of road construction materials;
- drainage management and hydrological impacts, particularly on Mulga communities;
- protection of rare flora;
- protection of threatened fauna;
- protection of plant communities having significant conservation value;
- management of weeds;
- rehabilitation; and
- public availability of the Environmental Management Programme.

In the Consultative Environmental Review the proponent prepared an extensive list of commitments which addressed the above issues. Following submissions from key agencies and interest groups, and negotiation with the Department of Environmental Protection a number of the commitments were revised such that the Environmental Protection Authority was satisfied the project was being managed in an environmentally acceptable manner.

Conclusion

The Environmental Protection Authority has evaluated the proposal to construct an east-west link road from Marandoo to Great Northern Highway, across Karijini National Park, and has concluded that the project is environmentally acceptable, subject to the recommendation contained in this report and the proponent's commitments.

Recommendation Number	EPA recommendation
1	The Environmental Protection Authority has concluded that the proposal by the Ashburton Shire Council to construct an east-west link road across Karijini National Park, from Marandoo to the Great Northern Highway is environmentally acceptable, subject to the implementation of the proponent's commitments, and recommends that it could proceed.

1. Introduction

1.1 Purpose of this report

This report and recommendations provides the Environmental Protection Authority's advice and recommendations to the Minister for the Environment on the environmental acceptability of the proposal to construct an east-west link road across Karijini National Park, from Marandoo to the Great Northern Highway.

1.2 Background

The Karijini National Park encompasses an area in excess of 600 000 hectares in the Hamersley Ranges of the Pilbara Region, Western Australia (Figure 1). Karijini National Park is vested in the National Parks and Nature Conservation Authority and managed by the Department of Conservation and Land Management (CALM).

The Department of Conservation and Land Management has prepared a Draft Management Plan for Karijini (previously known as Hamersley Range) National Park (CALM, 1989), and a second Draft Management Plan is now in preparation. In the discussion on road access into the park, the Department of Conservation and Land Management stated that they would liaise with Main Roads Western Australia and other authorities to achieve long term rationalisation of the number of park entry points. This included the development of a Marandoo to Mount Windell regional road as a major route through the park.

In October 1993 Main Roads Western Australia, as project manager, referred to the Environmental Protection Authority a proposal to construct a road between the newly constructed Marandoo Access Road and Mt Bruce Road (near Mount Windell). The road would provide a link between the two roads resulting in an east-west link across the park. The Environmental Protection Authority set the level of assessment at Consultative Environmental Review. An amended proposal was referred in June 1994 which proposed the construction of a road from the Marandoo Access Road to the Great Northern Highway, part of which would replace the existing Mt Bruce Road (Figure 2). The Environmental Protection Authority considered that the environmental issues for the amended proposal were essentially the same as for the original referral, and that it was appropriate that the amended proposal be assessed through the preparation of the Consultative Environmental Review.

The proponent for the road is the Ashburton Shire Council, and the project is being managed by Main Roads Western Australia.

1.3 Structure of the report

This report has been divided into 7 sections.

Section 1 introduces the report by stating its purpose, describing the historical background to the proposal and its assessment, and outlining the structure of the report.

Section 2 summarises the proposal. The proposal is described in more detail in the proponent's Consultative Environmental Review (Ashburton Shire Council, 1995).

Section 3 explains the method of assessment and provides a summary of the topics raised through the setting of guidelines and in public submissions. From these topics and others raised throughout the assessment process, those considered to be issues that require further evaluation by the Environmental Protection Authority are identified. A table summarising this process is provided (Table 1).

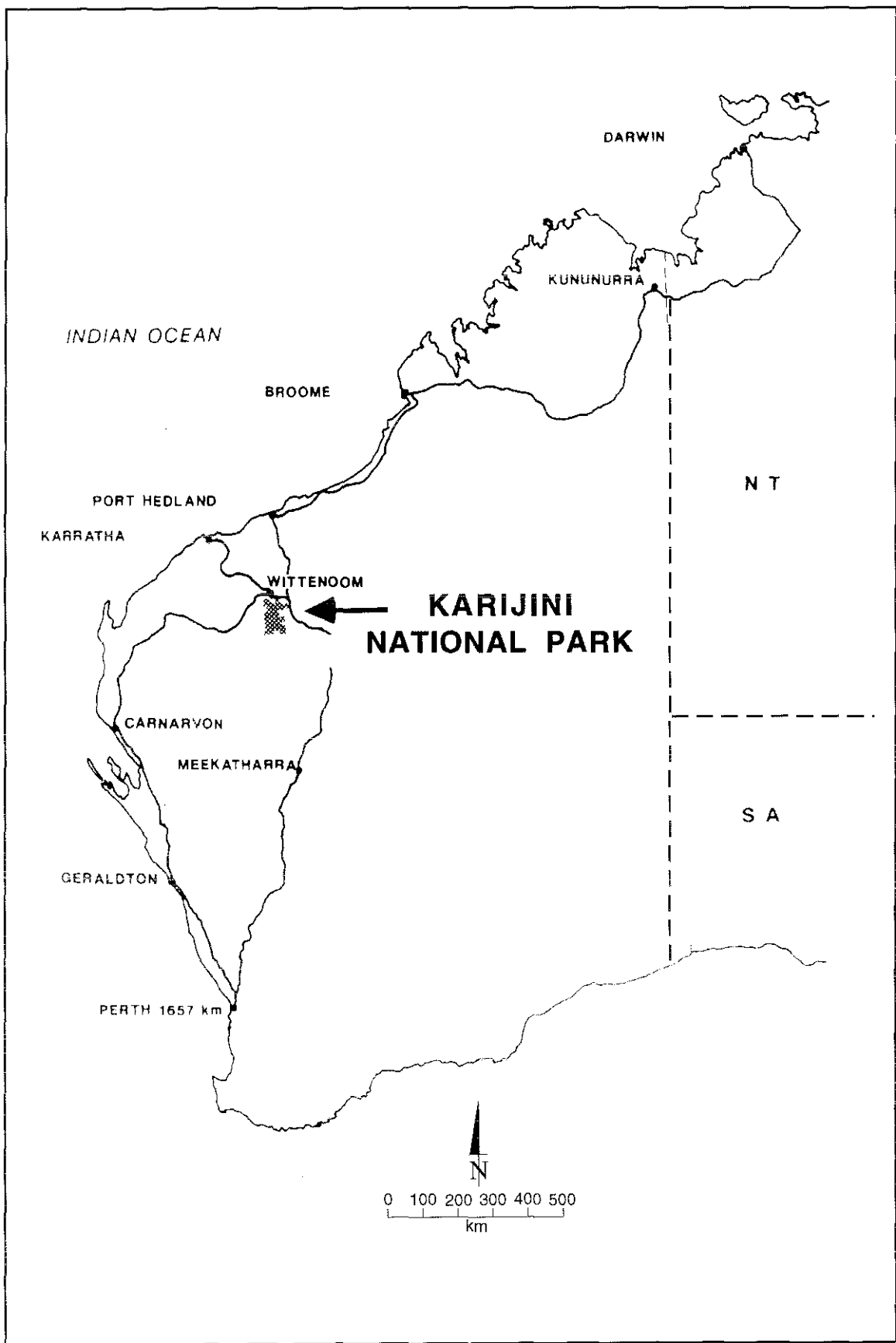


Figure 1. Location of Karijini National Park. (Source: CALM, 1989)

Section 4 sets out the evaluation of the environmental issues associated with the proposal. Each issue is dealt with in its own sub-section, which initially states the objectives of the assessment for that issue. The relevant Environmental Protection Authority policy is stated and any technical information is provided. Comments from key agencies/interest groups are summarised, and the proponent response is presented. The sub-section on each issue is concluded with the Environmental Protection Authority's evaluation in terms of achieving the stated objectives.

Section 5 summarises the conclusions and recommendations and includes a table summarising the evaluation of the environmental issues (Table 2). Section 6 describes the recommended environmental conditions. References cited in this report are provided in Section 7.

2. The proposal

The Ashburton Shire Council proposes to construct a 76 km road running east-west through the northern part of the Karijini National Park (Figure 2). The road will provide a link between the existing Marandoo Access Road and the Great Northern Highway, just north of Marillana Creek. The main objective of the road is to facilitate improved tourist access to the park. The road will also serve as an important road for general traffic.

The need for improved road access to the Karijini National Park was first recognised in the Pilbara Road Development Strategy which recommended an east-west link across the park (Main Roads Western Australia, 1988). A number of options across the park were considered but a northern corridor (Option A) was selected (Figure 3) because it would enhance the management of the park and did not encourage access to the wilderness areas in the southern region of the park. In addition, the corridor was the shortest in length, and would be the cheapest to construct because of fewer earthworks and drainage constraints.

The transport corridor proposed by the Department of Conservation and Land Management in the Hamersley Range National Park Draft Management Plan (CALM, 1989) was consistent with the outcomes of the Pilbara Road Development Strategy. The northern corridor was selected as the only viable option to service both the park and community needs. Following the selection of the suitable corridor, the Ashburton Shire Council and Main Roads Western Australia undertook extensive investigation and consultations to determine the exact alignment.

3. Identification of issues

3.1 Method of assessment

The purpose of the environmental impact assessment is to determine whether a proposal is environmentally acceptable, or under what conditions it could be environmentally acceptable.

A set of administrative procedures has been identified (refer to flow chart in Appendix 1) in order to implement this method of assessment.

The first step in the method is to identify the environmental topics to be considered. A list of topics (or possible issues) is identified by the Environmental Protection Authority through the preparation of guidelines which are referred to relevant agencies and interest groups for comment prior to being finalised.

These topics are then considered by the proponent in the Consultative Environmental Review both in terms of identifying potential impacts as well as making project modifications or devising environmental management strategies.

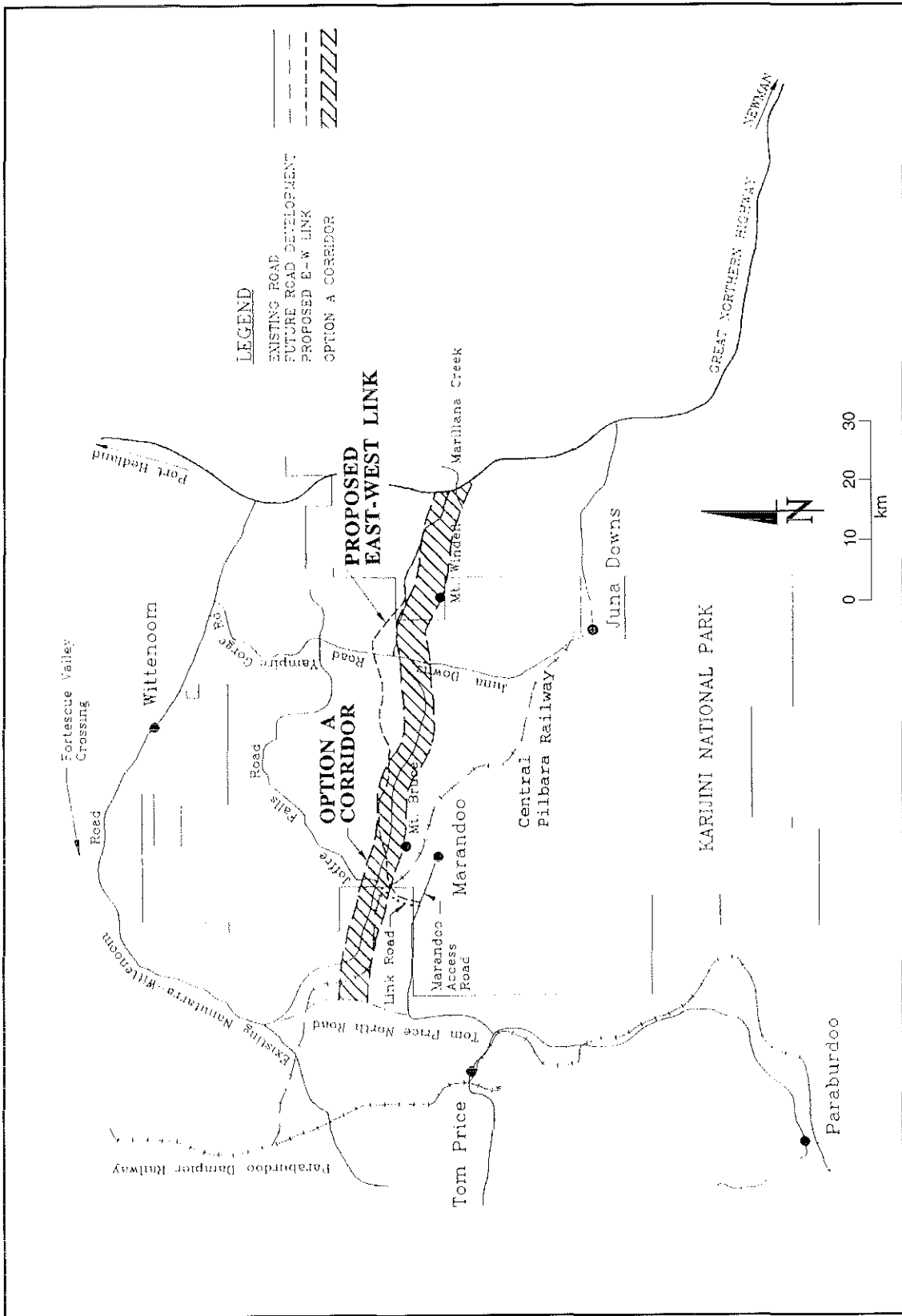


Figure 3. Proposed east-west link road in relation to existing railway and option A corridor. (Source: Ashburton Shire Council, 1995).

The Consultative Environmental Review is checked to ensure that the proponent has discussed each topic in sufficient detail prior to release for review and comment by government agencies and members of the public. Following the completion of the public review period, the submissions received are summarised by the Department of Environmental Protection on behalf of the Environmental Protection Authority.

Proponents are invited to respond to the topics raised in the submissions. Appendix 2 contains a summary of the topics raised in the submissions and Appendix 3 contains the proponent's response to those topics. Ten submissions were received, of which eight were from government agencies and two from conservation groups and the public. A list of submitters appears in Appendix 4.

At this stage the process had resulted in the identification of 16 topics, varying in environmental significance. The Environmental Protection Authority considers all the topics and identifies those that are not environmentally significant and do not require further evaluation. Often these topics can be addressed through the processes of other agencies or have been adequately addressed by the proponent commitments. The remaining topics are considered to be issues of environmental significance that require further evaluation by the Environmental Protection Authority.

For each environmental issue, an objective is defined and relevant policy and technical information is provided. The expected impact of the proposal, with due consideration to the proponent's revised commitments to environmental management, is then evaluated against the assessment objective (Appendix 5). If the commitments meet the assessment objectives, there is no need for the Environmental Protection Authority to make recommendations to the Minister for the Environment on that issue. Where the proposal, as defined by the proponent, has unacceptable environmental impacts, the Environmental Protection Authority can either advise the Minister for the Environment against the proposal proceeding or make recommendations to ensure the environmental acceptability of the proposal.

Limitations

This evaluation has been undertaken using information currently available. The information has been provided by the proponent through preparation of the Consultative Environmental Review document (in response to guidelines issued by the Environmental Protection Authority), by Department of Environmental Protection officers utilising their own expertise and reference material, by utilising expertise and information from other State government agencies, information provided by members of the public, and by contributions from Environmental Protection Authority members.

The Environmental Protection Authority recognises that further studies and research may affect the conclusions. Accordingly, the Environmental Protection Authority considers that if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Environmental Protection Authority.

3.2 Public and agency submissions

Comments were sought on the proposal from the public, interest groups and local and State government agencies. During the public submission period from 28 August to 25 September 1995, ten (10) submissions were received. A summary of these submissions was forwarded to the proponent for response (Appendix 2). Submissions received by the Environmental Protection Authority were within the following categories:

- 2 from interest groups and organisations; and
- 8 from State and other government agencies.

The principal topics of concern raised in the submissions were:

Biophysical

- alternative routes and their impacts on the national park;
- source of road construction material;
- weed control;
- park disturbance/minimisation of impacts on the national park;

Social Surrounds

- Aboriginal heritage;
- visual impacts;
- tourism pressure; and

Other

- public availability of the Environmental Management Programme.

The Environmental Protection Authority has considered the submissions received and the proponent's response as part of the assessment of the proposal.

3.3 Review of topics

3.3.1 Identification of topics

Sixteen topics were raised during the environmental impact assessment process including those topics identified in the Environmental Protection Authority's guidelines, subsequent consultations and the submissions described above. The topics are as follows:

Biophysical

- alternative routes and their impacts on the national park;
- source of road construction materials;
- drainage management and hydrological impacts, particularly on Mulga communities;
- protection of rare flora;
- protection of threatened fauna;
- protection of plant communities having significant conservation value;
- management of weeds;
- park disturbance/minimisation of impacts on national park;
- rehabilitation;
- fire management;

Pollution

- disposal of waste generated during construction;
- dust generation;

Social Surrounds

- Aboriginal heritage;
- visual impacts;
- tourism pressure; and

Other

- public availability of the Environmental Management Programme.

The Environmental Protection Authority has evaluated the above topics and considers that a number of them can be managed by the proponent in accordance with their environmental management commitments, and in consultation with the Department of Conservation and Land Management (see Table 1). The topics which do not require further evaluation by the Environmental Protection Authority are discussed below. The remaining topics become issues requiring Environmental Protection Authority evaluation (see section 3.3.2).

Biophysical

Park Disturbance/minimisation of impacts on national park

This is a general topic and one that is addressed within a number of the other topics.

A public submission stated that minimal disturbance during construction needs to be a priority. The submission also stated that the Department of Conservation and Land Management should oversee the construction of the road, and should be allocated sufficient resources to carry out the task.

The Environmental Protection Authority considers that the minimisation and management of impacts on the national park is fundamental to the assessment and that this topic is related to all the topics and issues evaluated.

The majority of the commitments made by the proponent are to the satisfaction of the Department of Conservation and Land Management, who will provide advice to the Department of Environmental Protection and the Environmental Protection Authority to enable the auditing of compliance with environmental conditions and commitments. The resourcing of the Department of Conservation and Land Management is a matter which the Environmental Protection Authority is unable to comment on.

Further evaluation of this general topic by the Environmental Protection Authority is not required because the significant aspects covered by the general topic are considered in the evaluation of other topics and issues.

Fire Management

This topic was identified in the Environmental Protection Authority's guidelines for the preparation of the Consultative Environmental Review. Within their document the proponent committed to a number of management measures which adequately address the topic of fire management (Commitments 21 - 24 and 39).

The management of fire is a normal requirement when working in national parks and will be addressed to the satisfaction of the Department of Conservation and Land Management within the Environmental Management Programme. Further evaluation of this topic by the Environmental Protection Authority is not required.

Pollution

Disposal of Waste

The proponent has made a number of commitments with regard to the disposal of waste that may be generated in the construction of the road (Commitments 21, 24, 40 and 41).

This management of waste is a normal requirement when working in national parks and will be addressed to the satisfaction of the Department of Conservation and Land Management within the Environmental Management Programme. Further evaluation of this topic by the Environmental Protection Authority is not required.

Dust generation

The proponent has committed to applying water to trafficked areas to prevent dust generation (Commitment 43).

It is considered that management of dust is a normal requirement associated with construction activities. The topic will be addressed to the satisfaction of the Department of Conservation and

Land Management. Further evaluation of this topic by the Environmental Protection Authority is not required.

Social

Aboriginal Heritage

The public submissions raised concerns regarding how the commitments on Aboriginal heritage will be met and how they will be monitored. It was also raised that communication with a local Aboriginal representative would be advantageous.

The proponent response stated that the Department of Conservation and Land Management rangers based in the national park have extensive knowledge of the region's Aboriginal heritage issues. In addition, the Environmental Protection Authority received a submission from the Aboriginal Affairs Department which states that the proponent has undertaken satisfactory measures to abide by the provisions of the *Aboriginal Heritage Act* (1972) and the recommendations of that department.

The Environmental Protection Authority considers that the predicted impacts of the road on Aboriginal heritage values can be adequately managed through processes outside the *Environmental Protection Act* (1986).

Visual Impacts

Submissions raised the point that the road will cause visual impacts, particularly from Mount Bruce and where cut and fill is required.

The Environmental Protection Authority is aware of the potential for impacts on visual amenity, particularly from Mount Bruce, but considers this topic has been adequately discussed within the Consultative Environmental Review and can be managed by the proponent in consultation with the Department of Conservation and Land Management. The proponent has committed to designing individual road elements to minimise the visual impact of new construction (Commitment 15). This would involve consultation with a landscape architect such that the landscape is compatible with the existing environment and any significant amendment to the design during construction will require the approval of the Department of Conservation and Land Management (Commitment 27).

Further evaluation by the Environmental Protection Authority is not required.

Tourism Pressure

A public submission stated that any tourist developments resulting from improved access to the national park should be established outside the park.

The Environmental Protection Authority, in its evaluation of the proposal, has not considered the potential for further tourism developments. This is largely an issue that would be managed by the Department of Conservation and Land Management. Developments which could have significant environmental impacts would require referral to the Environmental Protection Authority to determine if environmental assessment is required.

Further evaluation by the Environmental Protection Authority is not required.

3.3.2 Issues requiring EPA evaluation

Table 1 summarises the process used by the Environmental Protection Authority to evaluate the topics raised during the environmental impact assessment process. The table identifies the topics and the proposal characteristics in relation to the topic. The comments received from government agencies and the public on the topic assist the Environmental Protection Authority in determining the environmental significance of the topic. If the topics are deemed to be environmentally significant they become issues and are then carried over to Section 4 where they are further evaluated by the Environmental Protection Authority (as summarised in Table 2).

Table 1. Identification of issues requiring EPA evaluation

TOPIC	PROPOSAL CHARACTERISTICS	GOVERNMENT AGENCY COMMENTS	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Biophysical				
Alternative routes and impacts on the national park.	The preferred alignment would provide another transport corridor across the park.	The road improves access between regional mining centres and will improve visitor access to the park whilst limiting access to remote wilderness area in the south of the park.	Road should be within current railway corridor to minimise park dissection and visual impacts.	EPA EVALUATION REQUIRED refer table 2 (Issue 1).
Source of road construction materials.	Materials removed from gravel and borrow pits outside the national park, where possible. Some from existing pits within the national park.	CALM has approved use of the existing gravel pits within the national park, but considers that no new gravel pits should be established within the park.	Material should be sourced from outside the national park.	EPA EVALUATION REQUIRED refer table 2 (Issue 2).
Drainage management and hydrological impacts, particularly on Mulga communities.	Approximately 6.3 km of the 76 km proposed alignment passes through Mulga communities.	Final road design should not impede overland / surface drainage. Monitoring programme necessary to detect any unacceptable changes to Mulga, and modify management measures if necessary.	None.	EPA EVALUATION REQUIRED refer table 2 (Issue 3).
Protection of rare flora.	Road passes through areas where Priority Flora have been identified.	Management necessary to mitigate deleterious impacts on Priority Flora.	None.	EPA EVALUATION REQUIRED refer table 2 (Issue 4).
Protection of threatened fauna.	Road traverses habitat of threatened and scarce fauna, particularly pebble mound mice.	Fauna identified on the alignment not likely to be affected because of their mobility and presence of similar habitat types nearby. Proponent should apply for permission to disturb pebble mound colonies, if disturbance unavoidable.	None.	EPA EVALUATION REQUIRED refer table 2 (Issue 5).
Protection of plant communities having significant conservation value.	Alignment traverses Mulga woodland (refer to drainage management section) and plant community identified as having significant conservation value at the western gully (jump-up).	Mulga woodland dealt with in drainage management section. CALM made no recommendations for management of the jump-up plant community, but considered that the recommended strategies for the priority flora contained within the community would provide for adequate protection of the plant community.	None.	EPA EVALUATION REQUIRED refer table 2 (Issue 6).

Table 1. Identification of issues requiring EPA evaluation (cont'd)

TOPIC	PROPOSAL CHARACTERISTICS	GOVERNMENT AGENCY COMMENTS	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Biophysical				
Management of weeds.	Construction activities could result in the introduction and spread of introduced species.	Careful management of construction operations is necessary to prevent the spread of weeds, including species other than those identified in the biological survey. Weed control programme should include biannual inspections for weeds.	None.	EPA EVALUATION REQUIRED refer table 2 (Issue 7).
Park disturbance / minimisation of impacts on national park.	Construction of the road through the national park will lead to removal of vegetation, involve some construction impacts and require rehabilitation following construction.	None.	Minimal disturbance during construction needs to be a priority and should be overseen by an independent body such as CALM, who should be appropriately resourced.	NO FURTHER EVALUATION REQUIRED BY EPA Significant aspects covered by this general topic are considered in the evaluation of other topics and issues.
Rehabilitation.	Areas affected by construction activities will require rehabilitation.	None.	None.	EPA EVALUATION REQUIRED refer table 2 (Issue 8)
Fire Management.	The construction of the road has the potential to increase the risk of fire.	The management of fire is a normal requirement when working in national parks.	None.	NO FURTHER EVALUATION REQUIRED BY EPA To be addressed to the satisfaction of CALM in the Environmental Management Programme.
Pollution				
Disposal of waste.	Plant maintenance areas and storage of contaminants to be restricted to areas outside park.	The management of waste is a normal requirement when working in national parks.	None.	NO FURTHER EVALUATION REQUIRED BY EPA To be addressed to the satisfaction of CALM in the Environmental Management Programme.
Dust generation.	Apply water to trafficked areas to prevent dust generation.	The management of dust is a normal requirement associated with construction activities.	None.	NO FURTHER EVALUATION REQUIRED BY EPA To be addressed to the satisfaction of CALM in the Environmental Management Programme.

Table 1. Identification of issues requiring EPA evaluation (cont'd)

TOPIC	PROPOSAL CHARACTERISTICS	GOVERNMENT AGENCY COMMENTS	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Social Surrounds				
Aboriginal Heritage.	Impacts on sites of significance to Aboriginal people.	Proponent has undertaken satisfactory measures to abide by provisions of the <i>Aboriginal Heritage Act 1972</i> .	Appropriate to have local representative to address issues that arise during construction. The question was raised as to who will monitor the restriction of access to Aboriginal sites, as stated in Commitments 2 & 3?	NO FURTHER EVALUATION REQUIRED BY EPA Predicted impacts on Aboriginal heritage values can be managed through processes outside the <i>Environmental Protection Act 1986</i> .
Visual Impacts.	Impacts on visual amenity, particularly from Mount Bruce.	None.	Concerns raised on visual impacts, particularly from Mount Bruce.	NO FURTHER EVALUATION REQUIRED BY EPA To be addressed to the satisfaction of CALM in the Environmental Management Programme.
Tourism pressure.	The road could lead to increased tourism pressure on national park.	None.	The road will increase pressure to establish tourist resorts along the road inside the park.	NO FURTHER EVALUATION REQUIRED BY EPA This topic is outside the scope of the assessment of the road proposal. New proposals which could have significant effects to be referred to EPA.
Other				
Public availability of the Environmental Management Programme.	Commitments to be addressed within Environmental Management Programme.	None.	The Environmental Management Programme should be available for public review and comment.	EPA EVALUATION REQUIRED refer table 2 (Issue 9).

The issues, as identified in Table 1, warranting further evaluation by the Environmental Protection Authority are:

- alternative routes and their impacts on the national park;
- source of road construction materials;
- drainage management and hydrological impacts, particularly on Mulga communities;
- protection of rare flora;
- protection of threatened fauna;
- protection of plant communities having significant conservation value;
- management of weeds;
- rehabilitation; and
- public availability of the Environmental Management Programme.

4. Evaluation of issues

4.1 Alternative routes and impacts on the national park

Objectives

The Environmental Protection Authority's objective, after the consideration of alternative alignments, is to ensure that where a road is required to pass through an area of high conservation value (eg national park), an alignment is chosen that minimises the environmental impacts on that area.

Policy

In the assessment of road proposals by the Environmental Protection Authority, the consideration of alternative alignments by the proponent is a fundamental component. For example, in the assessment of the central Pilbara railway, the Environmental Protection Authority was concerned that alternative routes were not adequately addressed within the proponent's environmental review document or in the proponent's response to public submissions (EPA, 1992) The Environmental Protection Authority suggested that alternative routes should be made explicit and the costs and benefits discussed.

Technical information

The construction of the east-west link road, as proposed, would result in another corridor through the national park. Given that there already exists a railway and a number of roads providing east-west access within the park, it was important to evaluate the need for an additional road which will dissect the park.

Comments from key agencies/interest groups

An interest group raised concern about the establishment of another corridor through the national park, when there is an existing corridor for rail which could accommodate the road.

The Department of Environmental Protection considers that the preferred route would direct visitors to existing tourist facilities, whilst the location of the road within the rail corridor would encourage access to the more remote wilderness areas in the southern region of the park.

The Department of Conservation and Land Management considers that the Shire's preferred route will improve visitor access to the park and causes the least impact on the park's major attractions. In their submissions, the Department of Conservation and Land Management and the National Parks and Nature Conservation Authority stated their in-principle support for the road and the preferred alignment, subject to the recommendations contained in the biological survey (refer Appendix 6).

Response from the proponent

The rail corridor was one of five options considered during extensive investigation to determine the most suitable corridor for a route across Karijini National Park. The preferred option was selected by the proponent as the best option suiting future management of the national park. In addition, the preferred option is shorter in length, involves significantly less earthworks and provision for drainage, and may improve visitor management in the national park.

Environmental Protection Authority Evaluation

As part of the evaluation of this issue the Environmental Protection Authority consulted with the National Parks and Nature Conservation Authority and the Department of Conservation and Land Management, who stated their in-principle support for the preferred option. The Environmental Protection Authority concurs with the advice given by the National Parks and Nature Conservation Authority and the Department of Conservation and Land Management and concludes that the proposed alignment will have the least impacts of feasible alternatives and will not have unacceptable impacts on the national park.

4.2 Source of road construction materials

Objective

The Environmental Protection Authority's objective is to ensure that road making materials are sourced outside areas of high conservation value.

Background

The Consultative Environmental Review states that borrow and gravel pits will be located outside the park where possible, and that where it is necessary to locate pits within the park, the sites will be chosen, the limits defined and management plans developed to the satisfaction of the Department of Conservation and Land Management.

Policy

The National Parks and Nature Conservation Authority has in place a Basic Raw Materials Policy that is concerned with access to basic raw materials within national parks, Nature Reserves and Conservation Parks. The policy permits access to basic raw materials from the conservation estate where the road or facility is within the estate and where use of the materials provides access for the protection and management of the estate, and provided that a more environmentally acceptable alternative is not available. The policy involves applying best practice rehabilitation to ensure that the biophysical values of the estate are maintained.

The Environmental Protection Authority has considered the acceptability of the extraction of road making materials from within the conservation estate in a number of assessments. In the assessment of the proposed upgrade and widening of Brookton Highway (EPA, 1993), the Environmental Protection Authority recommended that new borrow pits for the extraction of gravel should be located outside the area identified as having conservation value in the System 6 report. The Environmental Protection Authority considered that the commitments regarding rehabilitation and monitoring of borrow pits would ensure, as far as possible, the maintenance of the conservation and landscape values of the State Forest area surrounding Brookton Highway.

The Environmental Protection Authority position on road making materials in the Jurien to Green Head Road assessment was that it would be environmentally unacceptable to source road making materials from Lesueur and Drovers Cave National Parks (EPA, 1995) even if existing pits were available. The Environmental Protection Authority recommended that if the proponents did require road making material from other areas within the conservation estate or proposed additions to the conservation estate, this should be deemed a change of proposal under section 46 of the *Environmental Protection Act* 1986 and would require further assessment. For the Jurien to Greenhead Road, both the Environmental Protection Authority and the Department of Conservation and Land Management did not support access to materials within the Lesueur and Drovers Cave National Parks. This was largely because of the recognition that the land was of the highest conservation value.

Comments from key agencies/interest groups

One public submission stated that the source of building material should be from outside the park.

The Agriculture Protection Board considered that materials taken from water courses could be infested with seeds of introduced species and any resultant new germinations along the road needed to be eradicated.

The Department of Conservation and Land Management has given approval for the use of existing gravel pits within the national park, subject to the Environmental Conditions set as a result of this assessment, but has stated that no new gravel pits are to be established within the park itself. The sites approved require inspection prior to use and may be subject to restrictions on use, as determined by the Department of Conservation and Land Management.

Response from proponent

The proponent has amended Commitment 16 relating to the location of borrow and gravel pits. The original commitment stated that the borrow and gravel pits will be located outside the park where possible. Following the advice from the Department of Conservation and Land Management and negotiation with the Department of Environmental Protection, the commitment was amended to state that where materials need to be taken from within the national park, they will be taken from existing borrow and gravel pits, only where approved by the Department of Conservation and Land Management.

In addition, management plans for all borrow and gravel pits will be developed for inclusion in the Environmental Management Programme (Commitment 17).

These commitments should be addressed to the satisfaction of the Department of Conservation and Land Management.

Environmental Protection Authority Evaluation

The Environmental Protection Authority is aware that the extraction of road construction materials from conservation areas can adversely affect the conservation values attributable to those areas. The environmental acceptability of the extraction of road construction materials is assessed on a case-by-case basis, based on environmental values and advice from the National Parks and Nature Conservation Authority and the Department of Conservation and Land Management.

As illustrated by the Jurien to Green Head Road assessment, the Environmental Protection Authority does not support the extraction of road construction materials from areas of the highest conservation value. This decision was based on advice on the conservation value of the area as given by the National Parks and Nature Conservation Authority and the Department of Conservation and Land Management, and in a report on the nature conservation, landscape and recreation values of the Lesueur area (Burbidge, Hopper & van Leeuwen, 1990).

In the assessment of the upgrade and widening of Brookton Highway, the Department of Conservation and Land Management considered that the removal of construction materials from existing gravel pits within the conservation areas was acceptable. The Environmental Protection Authority recommendation supported this view.

For this assessment, the Department of Conservation and Land Management has advised Main Roads Western Australia (the project managers) that, subject to the environmental conditions set as a result of this assessment, it is acceptable for construction materials to be taken from existing gravel pits within the Karijini National Park.

Given the approval by the Department of Conservation and Land Management and the proponent commitments, the Environmental Protection Authority has concluded that the extraction of road construction materials from within the park, as approved by the Department of Conservation and Land Management is environmentally acceptable. The issue will be further addressed by the proponent in the Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management.

4.3 Drainage management and hydrological impacts, particularly on Mulga communities

Objective

The Environmental Protection Authority's objective is to ensure that the road does not impair drainage movement and consequently impact upon Mulga communities.

Policy

In the Environmental Protection Authority's assessment of the Marandoo Iron Ore Mine and Central Pilbara Railway, the significance of the Mulga woodland was recognised and a recommendation was made to ensure the Mulga woodland is protected from drainage impacts (EPA, 1992). This involved the preparation and implementation of a drainage management plan in consultation with the Environmental Protection Authority and the national park managers. It was determined the drainage management plan should include a monitoring component to determine the effectiveness of the drainage management measures.

Technical information

The Mulga woodlands in the eastern Pilbara are biologically unique, differing from other Mulga communities which are normally found further south, in that they lie within the tropics and in a semi-arid area with strongly seasonal summer rainfall (CALM, 1995).

The root systems of Mulga are adapted to obtaining water from surface soil, and the distribution and abundance of the Mulga is, therefore, determined by soil moisture and the pattern of surface drainage. Mulga depends upon overland sheet flow of water for survival and any impediment to this flow can have a significant impact. Particular attention in the design and construction of the road needs to be given to the maintenance of sheet flow regimes.

Comments from key agencies/interest groups

The Department of Conservation and Land Management undertook biological surveys on behalf of the Ashburton Shire Council. The survey identified that approximately 6.3 km of the 76 km proposed alignment traverses areas of Mulga woodland (Figure 4). In these areas it would be necessary that drainage management is undertaken such that the hydrological regime is not altered. The Department of Conservation and Land Management made a number of recommendations to reduce impacts on the Mulga woodland (refer Appendix 6).

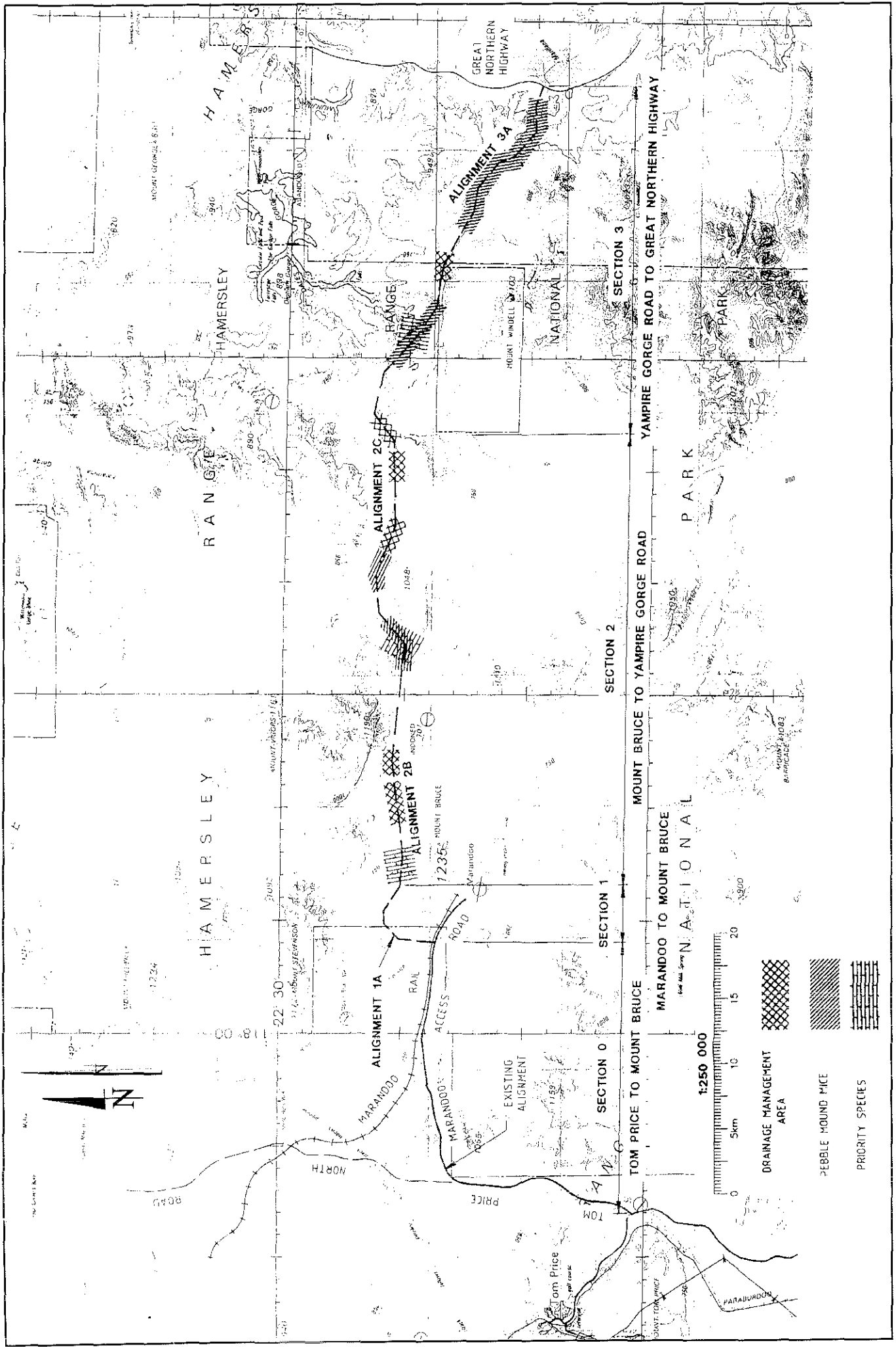


Figure 4. Location of Mulga Woodland priority flora and Pebble Mound Mouse habitat. (Source: adapted from Ashburton Shire Council, 1995).

Response from the proponent

The proponent has made several commitments regarding the issue of drainage management and the reduction of impacts on Mulga communities, which are to be fulfilled to the satisfaction of the Department of Conservation and Land Management (Commitments 3 - 7). These commitments comprise:

- Drainage treatments in accordance with recommendations of the biological surveys;
- Conducting routine inspections of areas affected by construction activity;
- Undertaking monitoring of effects on drainage and erosion;
- Implementing corrective measures as required; and
- Design treatments specifically in relation to Mulga communities.

Environmental Protection Authority Evaluation

The Environmental Protection Authority has concluded that the commitments made by the proponent, and the measures outlined in the Consultative Environmental Review, meet the Environmental Protection Authority's objectives in relation to drainage management and impacts on Mulga communities. The issue will be further addressed in the Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management.

4.4 Protection of rare flora

Objective

The Environmental Protection Authority's objective is to ensure that the road does not have unacceptable impacts on flora declared rare under the *Wildlife Conservation Act* (1950).

Technical information

The Department of Conservation and Land Management undertook biological surveys on behalf of the Ashburton Shire Council. No Declared Rare Flora were found, but seven species of flora under consideration for gazettal as Declared Rare Flora (priority flora) were identified within the area of the proposed alignment (refer Figure 4).

Priority Two *Acacia dawsoniana*
 Acacia effusa
 Indigofera "ixocarpa"
 Indigofera "gilesii" (proposed for listing as Priority Two)

Priority Three *Eremophila "magnifica" subsp. "velutina"*

Priority Four *Brachychiton acuminatus*
 Eucalyptus pilbarensis

Priority flora may be under consideration for declaration as rare under the *Wildlife Conservation Act* (1950). Discussion on priority flora is provided below (CALM, 1995).

Priority Two - Taxa which are known from one or a few (generally < 5) populations, at least some of which are not believed to be under immediate threat. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

Priority Three - Taxa which are known from several populations, at least some of which are not believed to be under immediate threat.

Priority Four - taxa which are considered to have been adequately surveyed and which whilst being rare (but not yet declared as such), are not currently threatened by any identifiable factors.

Comments from key agencies/interest groups

The Department of Conservation and Land Management made a number of recommendations in order to mitigate the deleterious impact of construction of the road on the priority species (refer Appendix 6). Within the biological survey it is stated that implementation of the recommendations will ensure that the conservation status of the priority species identified remains unchanged (CALM, 1995).

Response from the proponent

The proponent made a number of commitments regarding this issue including a commitment to implement an Environmental Management Programme in accordance with the recommendations from the biological survey to the satisfaction of the Department of Conservation and Land Management (Commitment 8). The recommendations included the collection, storage and subsequent sowing of seed from priority species for rehabilitation purposes, and minor realignment of the road to avoid significant portions of the priority populations (refer Appendix 6).

Commitments 9 and 10 are concerned with the minimisation of clearing during the construction of the road, the objective being to minimise disturbance to flora and fauna.

Commitments 36 and 37 state that disturbance to flora and fauna will be minimised through management of personnel, such as the restriction of access to rare flora and the prohibition of firearms, projectile weapons and pets.

Environmental Protection Authority Evaluation

The biological survey undertaken by the Department of Conservation and Land Management did not identify any declared rare flora, so the Environmental Protection Authority's objective in this regard is met. The construction of the road will, however, have an impact on flora classified as priority flora.

The recommendations made in the biological survey by the Department of Conservation and Land Management aim to reduce the impacts on these species (refer Appendix 6). The proponent has committed to act in accordance with the recommendations. Accordingly, the Environmental Protection Authority has concluded that the project is unlikely to have unacceptable impacts on the flora identified as having conservation value. This issue will be further addressed in the Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management.

4.5 Protection of threatened fauna

Objective

The Environmental Protection Authority's objective is to ensure that the road does not have unacceptable impacts on fauna identified as threatened under the *Wildlife Conservation Act* (1950).

Technical information

The biological survey undertaken by the Department of Conservation and Land Management identified three species listed as Threatened and one listed as Scarce. These are:

<u>Threatened</u>	<i>Pseudomys chapmani</i>	Pebble mound mouse (refer Figure 4)
	<i>Falco hypoleucos</i>	Grey falcon
	<i>Conopophila whitei</i>	Grey honeyeater
<u>Scarce</u>	<i>Acanthiza chrysorrhoa</i>	Yellow rumped thornbill

Threatened fauna are those which are considered to be rare or likely to become extinct and are classified under Schedule 1 of the *Wildlife Conservation Act* (1950). The classification of scarce is not recognised under the *Wildlife Conservation Act* (1950), but is used in this instance because the Department of Conservation and Land Management considered the species to be unusual in the study area.

Comments from key agencies/interest groups

The Department of Conservation and Land Management consider that the impact of the proposed road upon vertebrate fauna is likely to be small (CALM, 1995). Threatened or restricted fauna identified on the alignment are either known to be secure in the vicinity of the survey area, or are likely to be little affected by the development because of their mobility and presence of similar habitat types nearby. The Department of Conservation and Land Management identified Pebble mound mice in the study area and it was recommended that the proponent apply for permission to disturb pebble mound colonies that may be affected by the construction of the road (refer Figure 4). The Department of Conservation and Land Management has granted the proponent permission to disturb the colonies subject to the environmental conditions set through this assessment.

Response from the proponent

The proponent has made a number of commitments related to this issue (Commitments 8 - 10). Commitment 8 states that the Environmental Management Programme will be implemented in accordance with the recommendations from the biological survey (refer Appendix 6). In relation to the protection of fauna, the biological survey recommends that the proponent apply for permission to disturb pebble mound colonies.

Commitments 9 and 10 are concerned with the minimisation of clearing during the construction of the road, the objective being to minimise disturbance to flora and fauna.

Commitments 36 and 37 state that disturbance to flora and fauna will be minimised through management of personnel, such as the restriction of access to rare flora and the prohibition of firearms, projectile weapons and pets.

Environmental Protection Authority Evaluation

The Environmental Protection Authority has concluded that the proponent's commitments on this issue meet the Environmental Protection Authority objectives. This issue will be further addressed in the Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management.

4.6 Protection of plant communities having significant conservation value

Objective

The Environmental Protection Authority's objective is to ensure that the road does not have unacceptable impacts on plant communities identified as having significant conservation value.

Policy

The Environmental Protection Authority considers there should be a representative system of areas set aside for the conservation of flora, fauna and landscape (EPA, 1983). These areas may support communities which have been deemed to be of significant conservation value because of their high floristic diversity, the presence of rare or priority flora, or because the

communities are threatened or poorly reserved. At present the Department of Environmental Protection is undertaking work to update the System Six recommendations which recognise areas of high conservation value on the coastal plain and the Darling Range, and recommends ways and means for their protection. The work involves the identification of areas of remnant bushland that contain plant communities of significant conservation value which are considered to be threatened or poorly reserved. The Environmental Protection Authority adopts a similar policy outside the metropolitan area with regards to communities of significant conservation value.

The Department of Conservation and Land Management recognised the conservation value of two community types within the biological survey undertaken on behalf of the Ashburton Shire Council (CALM, 1995). The first was a community of high floristic diversity within the western gully (jump-up) and the other was the Mulga woodland communities.

In a previous assessment, the Marandoo Iron Ore Mine and Central Pilbara Railway, the conservation value of the Mulga woodland was considered in the assessment and the Environmental Protection Authority recommended that a drainage management plan which provided the basis for the protection of the Mulga woodland from drainage impacts, be prepared and subsequently implemented.

Technical information

In the biological survey two plant communities of significance were identified. The first was located at the western gully (jump-up) and is of significance because of the high floristic diversity and the presence of three priority species.

The other community of significance is the Mulga woodland communities (refer Figure 4). The management of the road to minimise impacts on these communities is discussed in Section 4.3 - Drainage Management and hydrological impacts, particularly on Mulga communities.

Comments from key agencies/interest groups

The Department of Conservation and Land Management did not make any recommendations on management of the community found in the western gully as the recommendations for the priority flora would, if implemented, provide for adequate protection of the plant community (CALM, 1995).

A number of recommendations were made in the biological survey to assist in the management of Mulga woodland communities (refer Appendix 6).

Response from the proponent

The proponent has committed to implementing an Environmental Management Programme in accordance with the recommendations from the biological survey undertaken by the Department of Conservation and Land Management (Commitment 8).

The proponent has made several commitments regarding the issue of drainage management and the mitigation of impacts on Mulga communities, which are to the satisfaction of the Department of Conservation and Land Management (Commitments 3 - 7). These commitments are outlined in Section 4.3.

Environmental Protection Authority Evaluation

The Environmental Protection Authority has concluded that the commitments made by the proponent, and the drainage management measures outlined in the Consultative Environmental Review, meet the Environmental Protection Authority's objectives in relation to drainage management and impacts on Mulga communities. The issue will be further addressed in the

Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management.

4.7 Management of weeds

Objective

The Environmental Protection Authority's objective is to ensure that the construction and use of the road does not promote the introduction or the spread of weeds in the national park.

Policy

As part of the assessment of the Marandoo Iron Ore Mine and Central Pilbara Railway proposal (EPA, 1992), the Environmental Protection Authority considered that the management of weeds was a significant environmental issue. The Environmental Protection Authority recommended that prior to the commencement of construction the proponent prepare and subsequently implement a weeds management plan, which prescribed hygiene, monitoring and control measures.

Technical information

The Department of Conservation and Land Management identified five introduced vascular plant species in the surveyed alignment, which are widely distributed throughout the Pilbara region. One of these, *Rumex vesicarius* (Ruby Dock) is considered to be a serious environmental weed that can have major impacts on nature conservation values.

Comments from key agencies/interest groups

The Department of Conservation and Land Management's biological survey emphasised the need for control of *Rumex vesicarius*, in particular, and stated that the spreading of the weed into new areas of the national park would be an unacceptable impact. It was considered necessary that measures to prevent the introduction and spread of introduced plant species be initiated prior to construction. This would involve the eradication of introduced species during the construction and use of the road. The Department of Conservation and Land Management stated that they could provide or supervise the eradication programme.

It was recommended that an introduced species monitoring programme be developed to detect and eradicate outbreaks of introduced plant species, particularly *Rumex vesicarius*, along the proposed road alignment for a period of five years after the completion of the project.

In their submission on the Consultative Environmental Review, the Department of Conservation and Land Management reiterated their position regarding biannual inspections of the road alignment at times when weed species are likely to be readily observable. The National Parks and Nature Conservation Authority reinforced the statement in their submission.

In addition, the Department of Conservation and Land Management stated that the use of topsoil should be undertaken in such a fashion as to restrict the spread of weed species from their current range along the proposed alignment.

The Agriculture Protection Board of Western Australia considered that *Datura leichhardtii* (Native thornapple) and *Argemone mexicana* (Mexican poppy) should be included in the weed control programme. In addition, it was stated that road/sub base material taken from local water courses could be infested with seeds and any new germinations along the road needed to be eradicated.

Response from the proponent

The proponent's response to submissions stated that the Environmental Management Programme will specify procedures for control of all potentially occurring weed species, including those noted in the submission by the Agriculture Protection Board.

In addition, the following commitments were revised as a result of points raised in submissions and subsequent discussion with Department of Environmental Protection officers.

A weed control programme for inclusion in the Environmental Management Programme and in accordance with the recommendations from the biological survey will be developed and implemented prior to commencement of construction and during construction activity (Commitment 11).

Bi-annual inspection of all areas affected by construction activity will be carried out for a minimum of five years. Weed eradication measures will be implemented where required (Commitment 12).

These commitments will be fulfilled to the satisfaction of the Department of Conservation and Land Management and the Agriculture Protection Board.

Environmental Protection Authority Evaluation

The Environmental Protection Authority has concluded that the weed management measures proposed and committed to by the proponent, and amended as a result of submissions, meet the Environmental Protection Authority objective in regard to this issue. Weed management will be further addressed in the Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management and the Agriculture Protection Board.

4.8 Rehabilitation

Objective

The Environmental Protection Authority's objective is to ensure that areas within the national park that are disturbed by construction activity are rehabilitated.

Policy

In the assessment of the Marandoo Iron Ore Mine and Central Pilbara Railway, the Environmental Protection Authority endorsed the need for careful planning prior to construction, to ensure both the extent and the methods used for ground disturbing activity are consistent with sound environmental management (EPA, 1992). It was recommended that prior to the commencement of construction, rehabilitation plans be prepared and implemented in consultation with the national park managers and the Environmental Protection Authority.

In the assessment the Environmental Protection Authority emphasised the need for care in selecting species for rehabilitation. It was stated that failure to plan aspects of the rehabilitation on a site by site basis could result in the introduction of species to areas in which they do not naturally occur, which could impair the integrity of the national park. The Environmental Protection Authority recommended that all plant material used for rehabilitation should be sourced locally, and that the park managers should determine the acceptability of plant material used for rehabilitation.

Response from the proponent

In order to rehabilitate all areas disturbed by construction activity as soon possible, the proponent has made a number of commitments regarding rehabilitation (Commitments 25 - 30) comprising:

- Implementing a rehabilitation plan for all areas disturbed, encouraging natural regeneration and restoring natural drainage patterns;
- Rehabilitating sections of the previous road;
- Designing cut and fills for stability, erosion control and landscaping;
- Inspecting all rehabilitated areas for at least 5 years;
- Documenting success of rehabilitation measures; and
- Implementing additional rehabilitation if required.

Environmental Protection Authority Evaluation

The Environmental Protection Authority has concluded that the commitments made by the proponent and the measures outlined in the Consultative Environmental Review, meet the Environmental Protection Authority's objectives in relation to the rehabilitation of areas affected during the construction of the road. The issue will be further addressed in the Environmental Management Programme to the satisfaction of the Department of Conservation and Land Management.

4.9 Public availability of Environmental Management Programme

Objective

It is common procedure for the Environmental Protection Authority to recommend to the Minister for the Environment that an Environmental Management Programme be prepared to address a number of environmental issues that have been evaluated during the environmental impact assessment process. Where an Environmental Management Programme is required, and there is considerable public interest in the contents, it is the Environmental Protection Authority's objective to ensure that the Environmental Management Programme be publicly available (eg West Australian Petroleum Pty Ltd, Environmental Management Programme for the Saladin Field Development Thevenard Island, June 1988).

Comments from key agencies/interest groups

A public submission stated that the Environmental Management Programme should be available for public review.

Response from the proponent

The proponent revised Commitment 1, which is the proponent's commitment to prepare an Environmental Management Programme to address specific issues, to encompass public availability.

The proponent has committed to preparing the Environmental Management Programme prior to commencement of roadworks to the satisfaction of the Minister for the Environment on advice from the Department of Environmental Protection and the Department of Conservation and Land Management.

The Programme should address in detail, but not be limited to:

- (i) drainage management to minimise effects on Mulga woodland;
- (ii) protection of rare flora species;
- (iii) protection of threatened fauna;
- (iv) weed management;
- (v) rehabilitation; and
- (vi) construction impacts.

Environmental Protection Authority Evaluation

The Environmental Protection Authority has concluded that the proponent's commitment on this issue, including the public availability of the Environmental Management Programme, meets the Environmental Protection Authority objectives.

5. Conclusions and recommendations

The Environmental Protection Authority has concluded that the proposal by the Ashburton Shire Council to construct an east-west link road across Karijini National Park, from Marandoo to the Great Northern Highway is environmentally acceptable subject to the implementation of the proponent's revised commitments.

In reaching this conclusion, the Environmental Protection Authority identified the main environmental issues requiring consideration as:

- alternative routes and their impacts on the national park;
- source of road construction materials;
- drainage management and hydrological impacts, particularly on Mulga communities;
- protection of rare flora;
- protection of threatened fauna;
- protection of plant communities having significant conservation value;
- management of weeds;
- rehabilitation; and
- public availability of the Environmental Management Programme.

The Environmental Protection Authority believes that these issues are adequately addressed by the commitments made by the proponent, the proponent's response to the issues raised in public submissions and subsequent revision of commitments. A summary of the Environmental Protection Authority's evaluation of the issues is set out in Table 2.

The proponent has made a number of environmental management commitments to ameliorate the impacts arising from this proposal (Appendix 5). The Environmental Protection Authority considers that while the proponent should be required to implement all of the commitments, compliance with Commitment numbers 1 through 30 should be audited by the Department of Environmental Protection.

The Environmental Protection Authority is satisfied that, using information currently available, the following recommendation may be made to the Minister for the Environment.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal by the Ashburton Shire Council to construct an east-west link road across Karijini National Park, from Marandoo to the Great Northern Highway is environmentally acceptable, subject to the implementation of the proponent's commitments, and recommends that it could proceed.

Table 2. Summary of EPA evaluation

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENT	EPA EVALUATION
1 Alternative routes and impacts on the national park.	Ensure that, after the consideration of alternatives, where a road passes through an area of high conservation value (eg national park), an alignment is chosen that minimises the environmental impacts on that area.	The road would result in another corridor through the national park. Given that there are already existing roads and a rail corridor, it was important to evaluate the need for an additional road.		Support for alignment from CALM and NPNCA. EPA concurs, and considers alignment is satisfactory.
2 Source of road construction materials.	Ensure that road making materials are sourced outside areas of high conservation value.	Environmental acceptability of the extraction of road construction materials is assessed on a case-by-case basis based on environmental values and advice from the National Parks and Nature Conservation Authority and CALM.	Materials will be taken from existing borrow and gravel pits within the park, only where approved by CALM (Commitment 16).	In some cases EPA would recommend against the use of existing borrow pits with the national park, but in this case it was considered acceptable based on the assessment of the conservation value of the area and advice from NPNCA and CALM. Given this, the proponent's commitments are considered adequate.
3 Drainage management and hydrological impacts, particularly on Mulga communities.	Ensure that the road does not impair drainage movement and consequently impact upon Mulga communities.	Policy provided in previous assessment of the Marandoo Iron Ore Mine and Cental Pilbara Railway - significance of Mulga woodland recognised and recommendation made requiring drainage management and monitoring.	Treatments to minimise drainage impacts and soil erosion, particularly in nominated Drainage Management Areas. Areas affected to be inspected, environmental effects monitored and corrective action taken as required (Commitments 3 - 7).	Proponent's commitments are considered adequate.
4 Protection of rare flora.	Ensure that the road does not have unacceptable impacts on flora declared "rare".	No declared rare flora identified by CALM, but seven species of priority flora. CALM made a number of recommendations (as part of biological survey) to ameliorate impacts from the construction of the road.	Environmental Management Programme (EMP) to be implemented in accordance with recommendations from CALM's biological survey (Commitment 8). Minimisation of clearing during the construction of the road (Commitments 9 & 10).	Proponent's commitments are considered adequate.
5 Protection of threatened fauna	Ensure that the road does not have unacceptable impacts on fauna identified as "threatened".	CALM identified three species listed as Threatened and one listed as Scarce and made recommendations for their protection.	Minimise disturbance to flora and fauna by management of personnel (Commitments 36 & 37).	

Table 2. Summary of EPA evaluation (cont'd)

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENT	EPA EVALUATION
6 Protection of plant communities having significant conservation value.	Ensure that the road does not have unacceptable impacts on plant communities identified as having significant conservation value.	CALM identified two communities of significance and made a number of recommendations for the protection of the communities.	Implement the EMP in accordance with the recommendations from CALM's biological survey (Commitment 8). Commitments with regard to drainage management and mulga communities address this issue (Commitments 3 - 7).	Proponent's commitments are considered adequate.
7 Management of weeds.	Ensure that the construction and use of the road does not promote the introduction or the spread of weeds in the national park.	CALM and the Agriculture Protection Board identified a number of weed species and in addition to the proponent commitments, made recommendations for their management. As a result, the commitments were revised.	Develop and implement a weed control programme for all weeds, including those identified by the Agriculture Protection Board, in accordance with recommendations from the biological survey, including bi-annual inspection of areas affected by construction activity (Commitments 11 & 12).	Proponent's commitments are considered adequate.
8 Rehabilitation.	Ensure that all areas disturbed by construction activity are rehabilitated.	Emphasis placed on use of locally indigenous species in rehabilitation. CALM made recommendations regarding rehabilitation in biological survey.	<p>Implement a rehabilitation plan encouraging natural regeneration and restoring natural drainage patterns (Commitment 25).</p> <p>Rehabilitate sections of the previous road (Commitment 26).</p> <p>Design cut and fills for stability, erosion control and landscaping (Commitment 27).</p> <p>Inspect all rehabilitated areas for at least 5 years (Commitment 28).</p> <p>Document success of rehabilitation measures (Commitment 29).</p> <p>Implement additional rehabilitation if required (Commitment 30).</p> <p>Implement the EMP in accordance with recommendations from CALM's biological survey (Commitment 8).</p>	Proponent's commitments are considered adequate.
9 Public availability of the Environmental Management Programme.	Where there is considerable public interest in an EMP, ensure it is publicly available.		Commitment 1 involves the preparation of an EMP which will be publicly available.	Proponent's commitments are considered adequate.

6. Recommended environmental conditions

Based on its assessment of this proposal and the recommendation in this report, the Environmental Protection Authority considers that the following Recommended Environmental Conditions are appropriate:

1 Proponent commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

- 1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and revised in response to issues raised following public submissions; provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

A schedule of those Environmental Management Commitments (January 1996) which will be audited by the Department of Environmental Protection was published in Environmental Protection Authority Bulletin 805 (Appendix 5) and a copy is attached.

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

- 2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.
- 2-2 Where, in the course of the detailed implementation referred to in condition 2-1, the proponent seeks to change the designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Proponent

These conditions legally apply to the nominated proponent.

- 3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

4 Time limit on approval

The environmental approval for the proposal is limited.

- 4-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Department of Environmental Protection that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years.

5 Compliance auditing

To help determine environmental performance, periodic reports on progress in implementation of the proposal are required.

- 5-1 The proponent shall submit periodic Progress and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

- 1 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.
- 2 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

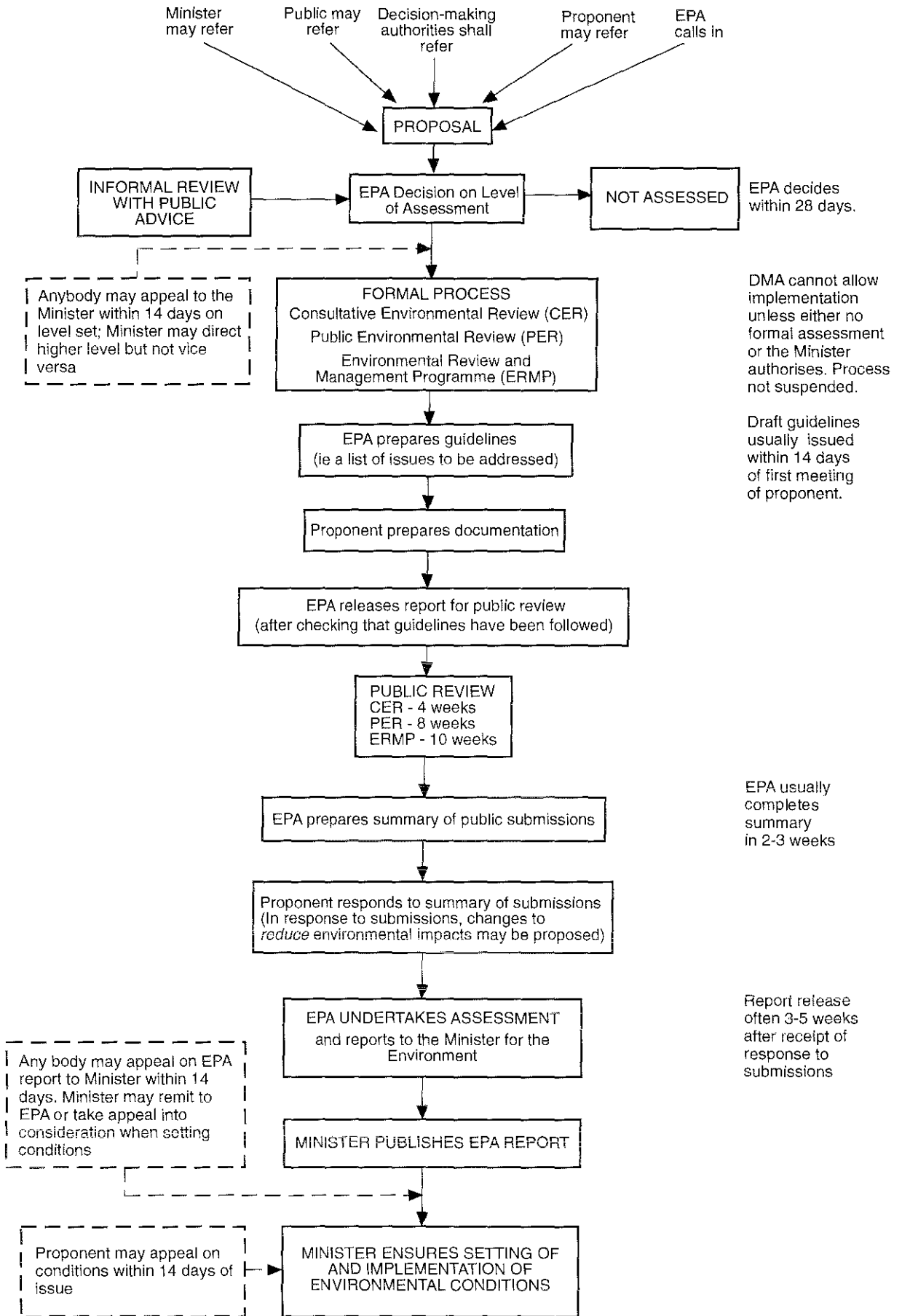
7. References

- Ashburton Shire Council (1995) Marandoo to Great Northern Highway, East West Link Road across Karijini National Park, Consultative Environmental Review, Ashburton Shire Council, Tom Price, WA.
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Appendix 1

Environmental Impact Assessment flow chart

EIA PROCESS FLOW CHART



Appendix 2

Summary of public submissions

Summary of Public Submissions

BIOPHYSICAL

Weed Control

The Native Thornapple (*Datura leichhardtii*) and Mexican Poppy (*Argemone mexicana*) are found in water courses within the area affected by the proposal. They should be included in the weed control program with a notation that road / sub base material taken from local water courses could be infested with seeds and any new germinations along the road must be eradicated.

Park Disturbance

Minimal disturbance during construction needs to be a priority and should be overseen by an independent body. If this is to be CALM then resources should be directed / allocated to that Department to ensure the work can be done.

Construction Material

Source material for the building of the road should be from outside the Park.

SOCIAL SURROUNDINGS

Aboriginal Heritage

The document states that access to Aboriginal sites will be restricted and project personnel will be aware of the provisions of the Aboriginal Heritage Act. Who will be monitoring this aspect of construction and what powers will they have to intervene if actions associated with construction are deemed to be in contravention of the commitment by the proponent?

To address any Aboriginal Heritage issues that arise during construction it would be advantageous to have direct communication with a representative with local knowledge.

Tourism Pressure

The construction of the road will increase pressure to establish tourist resorts along the road inside the Park. Any tourist developments should be established outside the Park.

Visual Impacts

The road will cause visual impacts, particularly from Mt Bruce.

OTHER

Alternative Route

The road should be put through on the current railway corridor reserved within the Park. This was the policy position of the former National Parks Authority.

Environmental Management Programme

The Environmental Management Programme should be available for public review and comment.

Appendix 3

Proponent's response to submissions

SHIRE OF ASHBURTON

Administration Centre, P.O. Box 567, Tom Price, 6751
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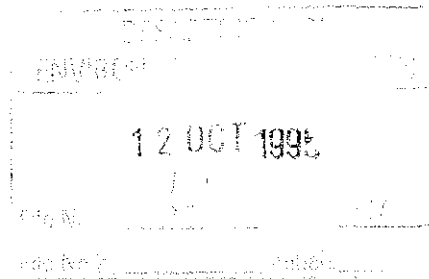
Our Ref: MTWL

All communications to be
addressed to Shire Clerk



RM:smb2 (RM2479)

9 October 1995



Director
Evaluation Division
Department of Environmental Protection
141 St Georges Terrace
PERTH WA 6000

Dear Sir

**RESPONSE TO PUBLIC SUBMISSIONS
MARANDOO TO GREAT NORTHERN HIGHWAY
EAST WEST LINK ACROSS KARIJINI NATIONAL PARK**

I refer to your correspondence of 28 September 1995 requesting response to questions raised during the public submission period for the above project. Comments addressing the issues raised follow.

1. BIOPHYSICAL

1.1 Weed Control

The prevention of the introduction and spread of weeds is an environmental management priority and was addressed in the Consultative Environmental Review (CER) by Environmental Commitments 12 and 13. A weed control programme will be developed in consultation with CALM prior to commencement of any construction activity. The programme, which will be included in the project's Environmental Management Plan (EMP), will detail procedures for control of all potentially occurring weed species, including those noted in the Public Submission (*Datura leichardtii* and *Agremone mexicana*).

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1.1 Weed Control (Continued)

All areas affected by construction activity will be inspected biannually and weed eradication measures implemented where required, for a minimum of five years after completion of construction.

1.2 Park Disturbance

The importance of minimising disturbance to the existing environment is reflected in the number of Environmental Commitments within the CER which specifically address the issue. Restricting clearing for construction activity is of particular significance and measures which will be implemented to ensure compliance include penalties applying to any activity outside designated clearing limits.

Prior to commencement of construction the Department of Conservation and Land Management (CALM) will be consulted in developing procedures for minimising disturbance, which will be included in the EMP. An independent body, reporting to Project Management, will also be supervising all works and will be responsible for the monitoring and enforcement of all the commitments made in the CER. This body will work very closely with CALM and will concentrate purely on construction activities. This will allow CALM resources to undertake their normal day to day activities.

1.3 Construction Material

The CER makes a commitment to locate borrow and gravel pits for road construction outside Karijini National Park where possible. The road will be designed to balance cuts and fills, obviating the need for borrow pits in the Park. Where material sources are by necessity located within the Park, management plans will be developed in consultation with CALM. Materials investigation to date indicates that the only materials sources within the Park which will be utilised are existing pits, therefore minimising disturbance. CALM has approved use of these proposed materials sources.

2. SOCIAL SURROUNDINGS

2.1 Aboriginal Heritage

An Environmental Induction Programme will be developed to ensure all personnel are aware of Environmental Commitments prior to arrival at the construction site. The Programme will ensure that all project personnel are aware of commitments with respect to Aboriginal Heritage. Penalties will be applied by Project Management for any breach of these commitments.

Project Management has maintained and will continue to maintain communications with representatives from Aboriginal groups involved in the Aboriginal Heritage Survey conducted as part of the CER.

2.1 Aboriginal Heritage (Continued)

It should also be noted that CALM Rangers currently based at Karijini National Park have extensive knowledge of the region's Aboriginal Heritage and were themselves involved in the aforementioned Survey. Local knowledge of Aboriginal Heritage issues is therefore readily accessible.

2.2 Tourism Pressure

The joint managers of Karijini National Park, CALM and the Karijini Aboriginal Corporation, are responsible for planning of future development within the National Park. CALM recently sought public submissions on a proposal for the development of tourist facilities in the Park.

Under the CALM Act, "Tourist resorts" or other developments would need to be in accordance with a management plan or compatible operations notice, which requires a minimum 8 week period for public consideration and submissions. Future development of tourist facilities within Karijini is outside the scope of this project.

2.3 Visual Impacts

The final alignment of the Marandoo to Great Northern Highway route has been selected so as to minimise visual impact of the road. Visual impact from Mt Bruce was of particular concern with visual intrusion being the major factor in determining the preferred alignment. Photography and video footage from a number of points on the ascent to the summit of Mt Bruce was used to assist in alignment selection. Minimising visual impact is a commitment in the design of individual road elements and design standards have been selected accordingly.

3. OTHER

3.1 Alternative Route

Extensive investigation between 1990 and 1994 was undertaken in determining the most suitable corridor for a route across Karijini National Park. The rail corridor extending south east from Marandoo (described as Option B in the CER) was one of five options considered.

The preferred route corridor (Option A) was selected as the option best suiting future management of the National Park. In comparison to the rail corridor, Option A is shorter in length, involves significantly less requirement for earthworks and provision for drainage, provides more direct access to existing tourist destinations and does not encourage access to wilderness areas in the southern half of the National Park. Option A is supported in principle by CALM and the National Parks and Nature Conservation Authority (NPNCA).

3.2 Environmental Management Plan (EMP)

The EMP will be a public document and is therefore available to any person or body who wishes to review it. Copies of the document will be available at Main Roads and Department of Environmental Protection Offices and at selected public libraries.

Should you require any further details regarding the above, please contact Mr Richard Mann of this Office.

Yours faithfully



L. A. Vicary
SHIRE CLERK

Appendix 4

List of submitters

LIST OF SUBMITTERS

Public / interest groups

Conservation Council of Western Australia

Pilbara Environment Group

Government agencies

Aboriginal Affairs Department

Agriculture Protection Board of Western Australia

Department of Conservation and Land Management

Department of Minerals and Energy

East Pilbara Shire Council

Minister for Transport

National Parks and Nature Conservation Authority

Western Australian Tourism Commission

Appendix 5

Summary of proponent's commitments

Summary of Proponent Commitments

ISSUE	OBJECTIVE	NUMBER	COMMITMENTS	PHASE	TO SATISFY
Environmental Management Programme	Address the commitments.	1	<p>Prepare an Environmental Management Programme addressing, but not limited to:</p> <ul style="list-style-type: none"> • drainage management to minimise effects on Mulga woodland; • protection of priority flora species; • protection of threatened or restricted fauna; • weed management; • rehabilitation; and • construction impacts. <p>The Environmental Management Programme will be publicly available prior to commencement of road works.</p>	Pre-construction	Minister for the Environment on advice from DEP & CALM
		2	Implement the approved Environmental Management Programme	Pre-construction Construction & Post-Construction	DEP & CALM
Hydrology	Minimise the impact on existing drainage patterns and minimise soil erosion.	3	Design and construct drainage treatments, in accordance with the recommendations from the biological survey, to minimise impact on existing drainage patterns and minimise potential for soil erosion.	Pre-construction & Construction	CALM
		4	Carry out routine inspection and maintenance of all areas affected by construction activity.	Construction & Post-Construction	CALM
		5	Undertake, in accordance with the recommendations from the biological survey, the monitoring and documentation of environmental effects such as drainage shadow and the incidence of active erosion in cuttings, drainage works, access tracks and other disturbed areas.	Construction & Post-Construction	CALM
		6	Implement corrective measures in consultation with CALM and other specialised agencies as required.	Construction & Post-Construction	CALM
	Minimise impact on Mulga communities.	7	Design and construct drainage treatments at locations defined as Drainage Management Areas in the biological survey, to minimise impact on Mulga communities where affected by the road alignment.	Pre-construction & Construction	CALM

Summary of Proponent Commitments

ISSUE	OBJECTIVE	NUMBER	COMMITMENTS	PHASE	TO SATISFY
Biology	Minimise disturbance to flora and fauna.	8	Implement an Environmental Management Programme (EMP) in accordance with the recommendations from the biological survey.	Pre-construction Construction & Post-Construction	CALM
		9	Restrict clearing to the absolute minimum required for construction activity. Restrict construction traffic to existing roads and designated clearing limits. Implement penalties for non compliance.	Pre-construction & Construction	CALM
		10	Do not permit sidetracks outside the limits for clearing.	Pre-construction & Construction	CALM
	Prevent the introduction and spread of weeds.	11	Develop and implement a weed control programme for inclusion in the EMP and in accordance with the recommendations from the biological survey, prior to commencement and during construction activity.	Pre-construction Construction & Post-Construction	CALM & Agriculture Protection Board
		12	Carry out bi-annual inspection of all areas affected by construction activity for a minimum of five years and implement weed eradication measures where required.	Post-Construction	CALM
Design and construction	Minimise the impacts of the road design and design standards.	13	Except at designated areas such as culverts sites and truck turn around areas, maximise batter slopes and restrict clearing width to 3m outside the limit of earthworks to reduce the requirement for clearing. The designated areas will be chosen in consultation with CALM.	Pre-construction & Construction	CALM
		14	Carry out road design in consultation with CALM to ensure environmental impacts are considered throughout the process.	Pre-construction & Construction	CALM
		15	Design individual road elements to minimise the visual impact of new construction.	Pre-construction	CALM
	Minimise the impacts of material sources.	16	Materials will be taken from existing borrow and gravel pits within the park only where approved by CALM.	Pre-construction & Construction	CALM
		17	Develop and implement management plans for all borrow and gravel pits for inclusion in the EMP.	Pre-construction Construction & Post-Construction	CALM
		18	Locate any new access tracks to avoid excessive removal of vegetation and disturbance to drainage patterns.	Pre-construction & Construction	CALM

Summary of Proponent Commitments

ISSUE	OBJECTIVE	NUMBER	COMMITMENTS	PHASE	TO SATISFY
Design and construction	Minimise the impacts of material sources.	19	Use existing water bores wherever possible. Locate additional bores with approval of CALM and in consultation with pastoralists and mining companies. Leave water bores intact for future maintenance and fire control.	Pre-construction Construction & Post-Construction	CALM
		20	Source sealing aggregate from existing or proposed hard rock quarries outside the National Park and implement a weed control programme before use.	Pre-construction & Construction	CALM
Design and construction	Minimise the impact of construction activity.	21	Develop and implement an environmental induction program and hygiene control for all personnel.	Pre-construction & Construction	CALM
		22	Make available water tankers and construction plant to assist in containing fires caused by construction activities.	Construction	CALM
		23	Ensure all plant is fitted with appropriate fire prevention equipment and adequate fire fighting equipment is provided at all construction sites.	Construction	CALM
		24	Restrict storage of contaminants and plant maintenance areas to camp sites and temporary compounds. Keep suitable materials to counteract spillage on hand at all times.	Construction	CALM
	Rehabilitate all areas disturbed by construction activity as soon possible.	25	Develop and implement a rehabilitation programme for all areas disturbed to encourage the natural regeneration of the pre-existing vegetation. Adopt rehabilitation measures to restore natural drainage patterns disturbed by construction activity.	Pre-construction Construction & Post-Construction	CALM
		26	Rehabilitate sections of existing road replaced by new road in accordance with the management requirements of the National Park.	Construction & Post-Construction	CALM
		27	Design cuts and fills for stability and rehabilitate to minimise erosion and provide a landscape compatible with the existing environment. Design will be undertaken in consultation with a landscape architect. Any significant amendment to the design during construction will require the approval of the Department of Conservation and Land Management.	Pre-construction, Construction & Post-construction	CALM
		28	Carry out routine inspection of all rehabilitated areas of construction activity for a minimum of five years.	Post-construction	CALM
		29	Document success of rehabilitation measures.	Post-construction	CALM
		30	Implement additional rehabilitation treatment in consultation with CALM if required.	Post-construction	CALM

Summary of Proponent Commitments

The following schedule of commitments will not be audited by the Department of Environmental Protection. The proponent is still, however, required to fulfil these commitments.

ISSUE	OBJECTIVE	NUMBER	COMMITMENTS	PHASE	TO SATISFY
Aboriginal Heritage	Avoid disturbance to Aboriginal archaeological and ethnographic sites wherever possible.	31	Seek permission under Section 18 of the Aboriginal Heritage Act (1972-1980) to disturb or remove archaeological sites designated Mt Bruce #1 to #4.	Pre-construction & Construction	Department of Aboriginal Sites
		32	Restrict access to Aboriginal sites and make project personnel aware of the provision of the Aboriginal Heritage Act which prohibits the unauthorised interference with Aboriginal sites.		
		33	Notify the Aboriginal Sites Department of the WA Museum of any further archaeological material which might be exposed during construction.		
Design	Minimise the impacts of the road design and design standards	34	Adopt a minimum 110 km/h horizontal design speed and a minimum 90 km/h vertical design speed to minimise clearing and earthwork quantities.	Pre-construction	CALM
		35	Locate and design parking bays and rest areas in consultation with CALM.	Pre-construction & Construction	CALM
Biology	Minimise disturbance to flora and fauna	36	Restrict access to rare flora and fauna habitats by construction personnel and equipment.	Pre-construction & Construction	CALM
		37	Prohibit possession of firearms, projectile weapons and pets by construction personnel.	Construction	
Design and Construction	Minimise the impacts of the road design and design standards	38	Design and construct fencing along the road alignment through Juna Downs Station to prevent livestock entering the Park.	Pre-construction & Construction	CALM
	Minimise the impacts of construction activity	39	Prohibit lighting of fires by construction personnel.	Pre-construction & Construction	CALM
		40	Locate construction camps outside the National Park.	Construction	CALM
		41	Dispose of refuse and treat waste (will be consistent with standard requirements of Local Authority) in accordance with the requirements of the Local Authority by-laws.	Construction	CALM
		42	Ensure all plant is fitted with appropriate noise suppression equipment.	Construction	CALM
	43	Apply water to trafficked areas to prevent dust generation.	Construction	CALM	

Appendix 6

**Summary of recommendations made by the Department of
Conservation and Land Management,
extract from the biological survey
(CALM, 1995)**

FLORA

The following recommendations (in bold) are proposed to mitigate the deleterious impact of road construction on the Priority Flora species identified above. Implementation of these recommendations will ensure that the conservation status of these species remains unchanged. The recommendations are:

Prior to commencement of road construction activities, collect seed from *Eucalyptus pilbarensis*, *Indigofera gilesii* and *Lixocarpa* for storage and subsequent sowing, once construction activities are complete, over cuttings, batters and embankments at the appropriate jump-up locations.

This work should commence prior to October 1995, if possible within the next two months, as all species are currently endowed with numerous fruiting structures. Seed should be stored under sterile conditions in a constant environment to prevent any reduction in seed viability through insect predation and fluctuations in ambient temperature. Sowing of the seeds on cuttings, batters and embankments should occur prior to the first significant rainfall event after completion of the road, preferably in March or April to maximise germination and seedling establishment. CALM's Science and Information Division, can provide this seed collecting, storage and sowing service.

A similar seed collection, storage and sowing strategy to that advocated above is recommended for *Acacia daweana* and *A. effusa*. This recommendation aims to promote these species along the batters and embankments of the new road in the vicinity of the populations identified in this study.

The collection, storage and subsequent sowing of seed from *Acacia daweana* and *A. effusa* will assist with conservation and minimise the deleterious impacts of this project on these species. Seed should be sown on the batters and embankments associated with the proposed road in close proximity to the populations identified during this study. It may also be appropriate to sow *A. effusa* seed onto areas of the existing Mt Bruce Flats Road, east of the proposed road alignment, once the existing road is closed, ripped and rehabilitated.

Re-align/reposition the proposed alignment 2C at its junction with the Mt Bruce Flats Road. This new alignment should intercept the Mt Bruce Flats Road at a point 150m east or 800m west of IP 25 (E616550, N7502070).

This re-alignment should occur immediately to prevent the passage of vehicles and associated machinery through the *A. daweana* population. Such a re-alignment will also protect a significant portion of the *A. effusa* population at this locality. If the re-alignment of 2C is to the east of IP 25 then restriction on widening of the existing Mt Bruce Flats Road will need to be enforced to protect numerous individuals of *A. daweana*. These restrictions will be particularly stringent on widening of the existing road in northerly direction as most *A. daweana* plants are located on the north side of the road and are in close proximity to the existing road. Re-alignment to the west will negate any such widening restrictions.

During construction of the alignment 2C through the western jump-up, collect and store topsoil material for re-application to cuttings, batters and embankments at this site upon completion of construction activities. Topsoil should be harvested from the top 200 mm of overburden material and re-applied as soon as practicable after completion of construction activities.

BORROW PIT FLORA

The following recommendation is made with reference to borrow pits:

Material for road base/sub base and sheeting should not be obtained from borrow pit 9 (E613400 - N7507700) as this pit is affiliated with the environmental weed *Rumex vesicarius*. This pit should be closed, rehabilitated and control measures initiated to eradicate *R.vesicarius*.

VEGETATION

The following recommendations are presented for the management of Mulga woodland communities located in Drainage Management Areas:

At locations identified as Drainage Management Areas, final road design should not impede overland/surface drainage.

This recommendation is paramount in the mitigation of the road's impacts on the flora and vegetation of the study area and is primarily concerned with limiting the development of drainage shadows. Reduction in the road's effect on surface drainage in Drainage Management Areas and mitigation of the impacts of any drainage shadows may be achieved by a number of engineering designs employed by Main Roads Western Australia. It is recommended that the most efficient of these designs is the construction of floodways flush with the existing topography. All other designs have weaknesses which do not eliminate the effect of drainage shadows.

Develop and commence a Mulga woodland monitoring program designed to document the health and survivorship of Mulga woodland communities and their constituent species at the Drainage Management Areas located along the proposed alignment of the road upon completion of construction.

This recommendation is suggested to ensure that the drainage management system employed at Drainage Management Areas along the proposed alignment of this road functions as anticipated. The monitoring program should be designed so that changes in the health and survivorship of Mulga woodland communities and their constituent species can be detected and remedial action can be taken to mitigate such impacts. The monitoring program will need to commence upon completion of the road and run for a number of years to document temporal change. CALM's Science and Information Division is able to design and run this monitoring programme.

The proponent make a commitment to modify the drainage management system employed at sites along the proposed alignment of the road where a reduction in overland/surface drainage is promoting unacceptable change to Mulga woodland communities.

The identification of sites where the drainage management system may need modification will be facilitated through the Mulga woodland monitoring program proposed above. Modifications to the drainage management system at these sites will hopefully mitigate the deleterious impacts promoted by the existing drainage systems and reduce subsequent deterioration in the health and survivorship of adjacent woodland communities.

This soil management practice will enhance the re-establishment of the diverse, species-rich flora currently located at the western jump-up and may assist with the perpetuation of the two Priority Flora *Indigofera* species which are present.

Establishment and persistence of these two Priority Flora species will be enhanced by their suggested opportunistic response to disturbance. This management practice may also enhance the re-establishment of *Eremophila magnifica* subsp. *velutina* which is notoriously difficult to propagate. Top soil recovery and storage should be for the shortest duration possible to ensure maintenance of seed viability and vigour.

INTRODUCED SPECIES

The following recommendations (in bold) are suggested to mitigate the impacts of introduced species:

Initiate environmental hygiene procedures to prevent the introduction and spread of introduced plant species and their propagules throughout the alignment of the route, especially in the Karijini National Park.

The development and introduction of an environmental hygiene procedure is designed to prevent the further spread of introduced species identified during this study and impede the introduction of 'novel' weeds. Such a procedure is pro-active and preventative in its approach rather than responsive which is usually costly and requires an ongoing commitment. Nature conservation values along the route will be maintained by a pro-active approach to introduced species, particularly environmental weeds.

Initiate control measures prior to construction which are designed to eradicate and impede the further spread of the environmental weed, *Rumex vesicarius*, throughout the proposed alignment, especially within the Karijini National Park.

The eradication of *R.vesicarius* from the seven locations along Route 2C prior to construction will diminish the environmental weed's potential to disperse along the road corridor during construction and in the years following completion of the road. Eradication of *R.vesicarius* prior to construction will reduce the potential for this species to deleteriously impinge on other areas of the Karijini National Park. CALM can provide or supervise this eradication program.

Establish an introduced species monitoring program to detect and eradicate outbreaks of introduced plant species, particularly *Rumex vesicarius*, along the proposed road alignment for a period of five (5) years after completion of the project.

The establishment and implementation of an introduced species monitoring program will facilitate the identification of 'novel' introduced species within the study area and will enable outbreaks of existing introduced species, particularly *R.vesicarius*, to be identified and controlled for a period of five years and involve at least biannual inspections. Inspections should include the road and its associated cuttings, embankments, batters and drains together with borrow pits and other sites disturbed during construction.

FAUNA

Impact of the proposed road upon vertebrate fauna is likely to be small. Threatened or restricted fauna identified on the alignment are either known to be secure in the vicinity of the survey area, or are likely to be little affected by the development because of their mobility and presence of similar habitat types nearby.

It is recommended that the proponent apply for permission to disturb pebble mound colonies.