

ASSESSMENT REPORT - NUMBER 11

**MARRAKAI - JABIRU
132kV TRANSMISSION
LINE ENVIRONMENTAL
ASSESSMENT REPORT**



DECEMBER 1988

ENVIRONMENT UNIT
CONSERVATION COMMISSION OF THE NORTHERN TERRITORY
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**MARRAKAI - JABIRU
132kV TRANSMISSION LINE**

**A REPORT ON THE ASSESSMENT OF POTENTIAL
ENVIRONMENT IMPACTS**

Environment Unit
Conservation Commission of the Northern Territory

December 1988

TABLE OF CONTENTS

	PAGE NO
ABBREVIATIONS	ii
1. INTRODUCTION	1
1.1 Environmental Assessment History	
1.2 Objectives of the Proposal	
1.3 Description of the Proposal	
1.4 Major Issues	
2. NEED FOR THE PROPOSAL	12
2.1 Assessment of Alternatives	
2.2 Preferred Option	
3. BIOPHYSICAL ENVIRONMENT, IMPACTS AND SAFEGUARDS	25
3.1 Introduction	
3.2 Flora and Fauna	
3.3 Soils and Geology	
3.4 Watercourses/Hydrology	
3.5 Conclusions	
4. SOCIAL ENVIRONMENT, IMPACTS AND SAFEGUARDS	39
4.1 Introduction	
4.2 National Parks and Tourism	
4.3 Mining	
4.4 Private and Pastoral Landuse	
4.5 Aboriginal Interests	
4.6 Sites of Importance	
4.7 Conclusions	
5. GENERAL CONCLUSIONS	46
6. RECOMMENDATIONS	49
REFERENCES	51
APPENDICES	
1. Public Examination Places, Marrakai-Jabiru 132kV transmission line Draft EIS	
2. List of Respondents	

List of Tables

Table 1 Summary of Respondents Comments
 on the Draft EIS

Table 2 Summary of Impacts, Safeguards and Final Effects

List of Figures

Figure 1 Location Map

Abbreviations

ANPWS	-	Australian National Parks and Wildlife Service
ASSPA	-	Aboriginal Sacred Sites Protection Authority
Aust. Cons. Found.	-	Australian Conservation Foundation
Aus. Peoples Rep. Council	-	Australian Peoples Representative Council
Big Scrub Env. Centre	-	The Big Scrub Environment Centre
CCNT	-	Conservation Commission of the Northern Territory
Con Council SE (Canberra)	-	Conservation Council of the South East (Canberra)
Cons Council SA	-	Conservation Council of South Australia
CSIRO	-	Commonwealth Scientific and Industrial Research Organisation
DASETT	-	Department of the Arts Sport the Environment, Tourism and the Territories (Commonwealth)
Dept. Health and C. Services	-	Department of Health and Community Services (NT)
Dept. T&W Roads NT	-	Department of Transport and Works, Roads Division (NT)
DID	-	Department of Industries and Development (NT)
DME Mines	-	Department of Mines and Energy, Mines (NT)
DPIF	-	Department of Primary Industry and Fisheries (NT)
EIS	-	Environmental Impact Statement
Env. Centre NT Inc	-	Environment Centre of the NT (Inc).
MRSB	-	McKinlay River Station Block
NLC	-	Northern Land Council
NT	-	Northern Territory
PAWA	-	Power and Water Authority (Northern Territory)
Qld. Cons. Council	-	Queensland Conservation Council
RUM	-	Ranger Uranium Mines

Tas. Con. Trust Inc. - Tasmanian Conservation Trust (Inc.)

Total Env. Centre Sydney - Total Environment Centre, Sydney

The Wilderness Soc. NSW - The Wilderness Society of New
South Wales

The Wilderness Soc. VIC - The Wilderness Society of Victoria

1. INTRODUCTION

This report assesses the environmental impact of the Marrakai-Jabiru 132kV Transmission Line, as presented in the draft and final Environmental Impact Statement (EIS). The report also reviews the proponent's response to comments received on the proposal during the public review period.

Included in the report is a discussion of potential impacts both beneficial and adverse on the biological, physical and socio-economic environment and recommendations on how adverse effects should be minimised or avoided.

The contents of the report form the basis of advice to the Northern Territory Minister for Conservation on the overall environmental acceptability of the proposal.

1.1 Environmental Assessment History

The proposal is to construct a 132 kilovolt (kV) transmission line to connect Jabiru to the Channel Island power grid. Environmental assessment of the project was conducted under a joint arrangement between the Commonwealth Department of the Arts, Sport, the Environment, Tourism and Territories (DASETT) and the Conservation Commission of the Northern Territory (CCNT).

In accordance with the provisions of the Commonwealth Environment Protection (Impact of Proposals) Act 1974 and the Northern Territory Environmental Assessment Act 1982, the Northern Territory Power and Water Authority (PAWA) was directed to prepare a Draft Environmental Impact Statement on 23 November 1987. Guidelines for the preparation of the EIS were compiled by DASETT in conjunction with CCNT.

The Draft EIS was formally submitted to the relevant Commonwealth and Northern Territory (NT) Ministers on 20 May

1988 and placed on public exhibition for a ten week period from 25 May 1988 to 2 August 1988 (see Appendix 1 - Public Examination Places, Marrakai-Jabiru 132kV Transmission Line Draft EIS). During the review period the proponent, PAWA, arranged two general public meetings at the Darwin Museum and Jabiru town centre. One member of the public arrived at the Darwin meeting and three at Jabiru.

Copies of the Draft EIS were also supplied to Northern Territory Government advisory bodies and appropriate Commonwealth authorities.

A total of 28 written submissions were received by DASETT and CCNT (see Appendix 2 - List of Respondents). Under the terms of the joint assessment arrangements all submissions were made available to the Commonwealth and NT Governments and to the proponent, to be taken into account in the preparation of the Final EIS. The major points raised by respondents to the Draft EIS are summarised in Table 1.

The Final EIS was submitted to the respective Commonwealth and NT Ministers on 22 November 1988. Northern Territory environmental assessment procedures required that the Final EIS be distributed to advisory bodies for examination and final comment. Advisory body comments are incorporated where relevant in following sections of this report.

1.2 Objectives of the Proposal

The two major objectives of the proposal are:

- (1) to supply the Alligator Rivers Region with a reliable supply of electrical energy that will meet future load increases at acceptable economic, social and environmental cost (p. 1,4; Final EIS); and

- (2) to improve the viability of the Channel Island Power Station and pipeline from the Amadeus Basin by increasing sales of energy from that system (p. 4; Final EIS).

1.3 Description of the Proposal

For a detailed description of the proposal refer to Section 4 "Project Description" in the Final EIS (p.8).

Briefly, the proposal is to construct a 132kv transmission line over a distance of 210km between the existing substation at Jabiru and a new station to be established at Marrakai on the 132kv transmission line, presently being constructed between Channel Island and Katherine. The proposal also involves the construction of a 22kv distribution system. This will include: a connection to Cooina via the 132kv transmission towers, a line following the Arnhem Highway to Kakadu Holiday Village and CSIRO research station at Kapalga, and a line to Gunbalanya.

The transmission line is considered by the proponent to be the preferred means of supply of energy to the region on the justification of cost, flexibility, capacity for expansion, security of supply, and from broad strategic considerations for planning by linking Darwin, Katherine and Jabiru into a network system.

The preferred route of the transmission line, both outside and inside Kakadu National Park, is considered by the proponent to be the Jim Jim option because:

- . it lies wholly within Crown land or pastoral lease;
- . it is generally located close to property boundaries;

- . it avoids swampy wet areas with difficult river crossings;
- . it avoids extensive areas of open grassland, thereby minimising visual impact;
- . it makes use of existing access corridors;
- . it minimises floodplain crossings;
- . there is good opportunity for visual screening; and
- . it is flexible, permitting power reticulation to Cooinda from Jabiru by way of a double circuit.

Route Description

The preferred route commences at Marrakai and crosses the Koolpinyah pastoral lease to the Adelaide River in an easterly direction. After by-passing a mining operation, the line traverses the southern foothills of the Mt Bunday Ranges to the McKinlay River Station. After crossing 5km through the McKinlay River Station Block (MRSB) recently acquired by the NT Government (referred to in the Final EIS as the proposed Mary River Park) the alignment by-passes the northern point of land proposed to be used as a field training area by the Department of Defence, meeting up with the Jim Jim road south of the Arnhem Highway.

The route follows the Jim Jim road to the Kakadu National Park boundary and is then directed north to avoid the Black Jungle Spring and Ranges. The route generally follows the Jim Jim Road until it reaches the Kakadu Highway.

The route then follows the Kakadu Highway into Jabiru where it connects with the Jabiru substation. The distance between the boundary of Kakadu National Park and the Jabiru substation is approximately 105km.

Vegetation, fauna and geographical features traversed by the preferred route are described in Section 6 of the Final EIS. The adequacy of the information provided, significance of the impacts, and safeguard details are discussed as part of the assessment in Section 3 of this report.

In general, the environment traversed by the route is described as wet/dry woodland and open forest, dominated primarily by Eucalyptus species. Other habitats encountered by the transmission line route include Melaleuca fringing forest, riparian forest, grassland and vine thicket.

Between Marrakai and Kakadu the land traversed by the transmission line is dominated by pastoral use; however, mining, military and conservation uses also occur. From the Kakadu National Park boundary to Jabiru the land use is conservation and tourism and the area is a proclaimed World Heritage National Park. Approximately half the length of the transmission line traverses through Kakadu.

Construction Description

The section between Marrakai and Cooida will be constructed using 26.9m tall lattice monopoles. Self supporting 29.7m tall lattice towers will be used at changes of direction and where the line terminates.

Between Cooida and Jabiru 23m concrete poles will be used. Each section of the transmission line will have two overhead galvanised steel earthwires.

Vegetation will be cleared under the transmission line to ensure security of operation, generally requiring 10-15m of clearing on either side of the centre line. Low growing vegetation will be allowed to regenerate.

Route survey, clearing and access, support structure positioning and assembly, and stringing are discussed on pp.11-12 of the Final EIS. Information regarding clean up and restoration along with project management, earthworks, maintenance and operation are provided on pp. 13-14 of the Final EIS.

Environmental safeguards regarding the clearing of the easement and construction and operation of the transmission line are discussed in Sections 3 and 4 of this report and are summarised in Table 2.

1.4 Major Issues

The major issues and impacts associated with the establishment of the proposed 132kV transmission line arising from public and government review of the EIS are:

- . the need to supply the Alligator Rivers region with electricity from Channel Island;
- . the adequacy of the socio-economic and environmental analysis of alternative power supply options;
- . the visual impact of the transmission line particularly in Kakadu National Park;
- . the aesthetic impact on the world heritage value of Kakadu National Park;
- . the compatibility of the proposal with the ANPWS Plan of Management for Kakadu;
- . potential for weed invasion and adequacy of safeguards;
- . the impact on fauna, particularly birds;

- . soil erosion and land alienation; and
- . adequacy of proposed safeguards.

2. THE NEED FOR THE PROPOSAL

Guidelines for the preparation of the EIS specifically required the need for the transmission line proposal to be fully examined. The proponent, in accordance with the guidelines, addressed this issue in Section 3 in the Final EIS, "Background and Need for the Proposal". The matter was also briefly discussed in response to public and government submissions (p.18, Final EIS).

One of the primary justifications for the proposal identified by the proponent stems from the objective to improve the viability of the Channel Island Power Station by increased sales of energy. The Katherine interconnected transmission line and the proposed Jabiru transmission line, will, according to the proponent, "be significant factors in improving system efficiency, and bring forward the date of achieving financial viability".

Until recently interconnected systems have not been considered to be economical due to the large distances between isolated power stations and the small quantities of energy requiring transmission. The proponent considers that the inclusion of the Alligator Rivers Region in the interconnected Darwin/Katherine system is now "economically feasible and desirable".

This premise is, however, totally reliant upon Energy Resources of Australia Ltd agreeing to buy PAWA electricity via the proposed transmission line for the operation of Ranger Uranium Mine (RUM) and other facilities.

Evidence regarding an "agreement in principle" on this matter with RUM (see attachment, Final EIS) has been provided by the proponent. This agreement is, however, subject to final agreement on the commercial details and the RUM Board of Directors approval. Seven respondents (Table 1) requested evidence of a commitment by RUM to purchase power from PAWA if the proposal proceeds.

The proponent acknowledges that the transmission line will not be economically feasible if such an agreement with RUM does not eventuate and accordingly will not proceed at this point in time.

Apart from sales to RUM and Jabiru, other projected consumers likely to be connected in the short-term are Kakadu Holiday Village and the CSIRO research station at Kapalga. Generating facilities already exist at both these locations.

The proponent also justifies the proposal on the grounds of long-term demand, particularly from mining developments such as, Jabiluka, Koongarra and Nabarlek.

Another perceived long-term power demand is the growth of tourism in the Kakadu National Park. The proponent suggests that unless ANPWS limits numbers of tourists, there will be an ongoing need for tourist developments similar to Kakadu Holiday Inn and accommodation at Cooida.

In order to further justify the proposal the perceived disadvantages of the existing diesel power supply system are outlined in the Final EIS:

- . high cost of operation, both in terms of fuel and maintenance;

- . less than satisfactory standard of reliability;
- . noise pollution;
- . contribution to atmospheric pollution;
- . risk associated with the transport of large quantities of diesel fuel along the Arnhem Highway; and
- . lack of capability to cater for increases in demand (without installing additional plant).

On these grounds, the proponent concludes that the replacement of the existing arrangement with an integrated interconnected system is "economically, socially and environmentally desirable" (p.6, Final EIS).

In response to the Draft EIS 12 submissions (Table 1) had major concerns regarding the justification of the need for the project. The proponent has addressed these concerns on economic grounds only:

"A rigorous economic analysis of all reasonable alternatives has determined that a 132kv transmission system is economically the most favourable means of meeting the existing demand for electricity in the Alligator Rivers Region and for catering for additional requirements for electricity from all sources within the region in the future". (p.81, Final EIS)

All respondents who commented on this issue were in agreement that the Draft EIS did not prove or substantiate an existing demand that cannot be met by the current system. In brief, the following comments were made:

- . there is no proven need for additional power in the region - the demand has not been justified;
- . there is no real evidence to support the proposition that the current power supply is particularly unreliable, or that the transmission line would improve the reliability of supply;
- . RUM has shown that it has the capacity to meet additional demand for the mine and Jabiru area until well after 1999;
- . much of the basis of the power need/demand appears to be the development of Jabiluka and Koongarra mines which are controversial and speculative on environmental and political grounds. The mines will also be on mineral deposits some distance from the proposed arterial line and have a limited operational duration.
- . within Kakadu the power requirements for water supply, limited lighting, hot water and cooking appliances in are in some areas met by passive solar systems currently in place. ANPWS has no policy to provide reticulated power to any of its campsites;
- . the growth in tourism is difficult to predict. The exponential tourism growth currently observed is highly unusual and may not be sustained;
- . the risk associated with the transport of diesel, although not disputed, has not been quantified. There have not been any major spills in the area; and
- . noise pollution is considered to be a negligible impact since RUM is away from tourist areas. Similarly, air pollution must be considered in the context of

pollution also resulting from Channel Island and other social and bio-physical impacts associated with the proposal.

In conclusion, it is considered that the strongest justification for the proposal is that it will improve the viability of the Channel Island Power Station, as the proposed interconnection will be economically feasible, subject to agreement with RUM.

Whether or not this justification is sufficient for the proposal to proceed is ultimately a decision for Government.

2.1 Assessment of Alternatives

Five alternative means of providing electricity to the Alligator Rivers Region have been proposed (p.15, Final EIS). The options examined are:

- (1) Continue with the use of diesel generators at all load points (i.e. no change).
- (2) Centralised diesel generation with an electrical distribution network throughout the Alligator Rivers Region.
- (3) Gas pipeline from Pine Creek to Jabiru, a centralised power station with an electrical distribution network throughout the Alligator Rivers Region.
- (4) Use of Liquified National Gas (LNG) delivered to Jabiru, a centralised power station with an electrical distribution network.
- (5) A 132kV Transmission Line from Darwin to Jabiru, with an electrical distribution network throughout the Alligator Rivers Region.

Economic Analysis and Impact

The power supply alternatives are examined in Section 5 of the Final EIS and the results of the economic analysis are shown in Tables 3 and 4 on p.18. A spreadsheet of relative costs over a 30 year period is provided as an attachment to the Final EIS.

The economic analysis is based on net present value (NPV) criterion and is taken over 30 years. The analysis of costs also looks at power supply to Jabiluka and Koongarra and the worst case situation of supplying RUM and the Jabiru township only.

If all likely loads (Table 3, Final EIS) eventuate, options 2 and 3 are marginally equivalent, costing double that of the preferred option. Option 4, the LNG alternative, has the largest cost of the group - around \$190m more than the transmission line. On economic grounds alone the LNG option can be dismissed as a feasible alternative.

Two respondents raised questions over the economic analysis undertaken by the proponent, particularly in respect to risk/uncertainty, interest rates, and fuel costs.

The analysis in the Final EIS indicates that the economic impact in both the short-term and long-term can be expected to have a beneficial outcome. Analysis taken over 10, 20 and 30 years for the RUM and Jabiru supply indicates a saving of \$4m, \$14m and \$20m (plus or minus 10%) respectively on the existing system. The opportunity cost of replacing the existing system is considered to be negative as profits would result from the sale of the RUM units.

Profits made by PAWA from the sale of electricity to RUM, Jabiru and other mining and tourist developments in the region will be used to reduce the debt associated with the Channel Island Power Station, "This will advance the date when electricity tariffs can be reduced in real terms thereby benefiting the residents of the NT" (p.17, Final EIS).

Indirect positive economic impacts that will result from a network power system and supply to the Alligator Rivers Region include: savings to be made through efficient use of power over the entire network; and new development that might be attracted to the regions, as a result of the power supply.

By supplying new mines, such as Jabiluka and Koongarra, the economic benefits become more obvious, saving \$20m, \$53m and \$61m over 10, 20 and 30 years on the current supply arrangement (including the opportunity cost of 1400mL of diesel).

Environmental and Social Analysis

Information regarding this analysis is provided on pp. 19-25 of the Final EIS. In the analysis, each alternative is examined using environmental and social criteria, concentrating primarily on landuse issues. A comparison of the regional electricity supply options is also examined using a simple goal programming method of additive goal weighting. The adequacy of this technique is discussed later.

The LNG power source (option 4) is dismissed on environmental grounds due to the risks and hazards associated with LNG loaded tankers which are even greater than for diesel tankers.

The existing situation and the centralised diesel plant options are considered by the proponent to have a number of unquantified environmental and social penalties. The proponent notes the problem of the inevitable minor spills that occur at fuelling sites. The major concerns however, are the invasive nature of the diesel road trains travelling into Kakadu National Park (4.5 road trains per week) and the associated noise impact. The proponent has not however, recognised that the number of tourist buses entering Kakadu National Park makes the invasive nature of the road trains relatively insignificant.

The risk of accident and associated diesel spillage and loss of life are also considered as major disadvantages of these options.

The burning of fossil fuel and the contribution to the Greenhouse Effect is mentioned; as well as, noise pollution from private generating sets in Kakadu National Park.

The gas pipeline (option 3) is considered by the proponent to involve a greater environmental disturbance during the construction phase, disturbing top soil, vegetation and stream banks and beds, than the transmission line. The associated compression stations would also contribute to noise and air pollution.

The proponent acknowledges that on completion and rehabilitation of the pipeline the visual impact would be minimal. Furthermore the easement of the pipeline would be half that required for the transmission line. It should be noted that appropriate construction conditions can minimise adverse environmental impacts resulting from easement clearing for both options. Apart from the visual impacts of the transmission line both options would have similar long term ramifications.

The proponent is "convinced" that the preferred option 132kV transmission line is justified on: economic grounds; engineering logic; and for long-term environmental reasons. The long-term environmental reasons however, are not qualified.

The selection of the most appropriate means of providing supply, according to PAWA, involves the evaluation of the impacts of alternatives for supply on environmental and social priorities as they relate to regional land uses.

In regard to the service of Aboriginal communities, the Final EIS concludes that a transmission line is the best means of providing stability of supply. The Final EIS mentions the scenario of RUM closing down leaving Aboriginal communities and other communities such as Jabiru without electricity. Other scenarios such as mining developments are discussed in terms of their noise and air pollution if supplied with diesel generated power. This analysis does not, however, justify a transmission line to Jabiru, but provides evidence that a reliable power source is necessary.

In considering conservation requirements, the impact on Park values and the environment are addressed. PAWA concludes that, "there is a need for formal electricity services to the region; there is a need to ensure that the service does not detract from Park values; and there is a need to ensure that the service meets other community priorities efficiently". PAWA does not, however, indicate a preferred power source for this land use and does not consider the ANPWS Kakadu Plan of Management which recommends that power reticulation within the Park be underground.

Tourism and mining land uses are briefly outlined in the Final EIS and the transmission line, in both cases, is offered as the best option. Since all options result in power supply to the Alligator Rivers Region this is not a valid conclusion.

In presenting the transmission line as the preferred option PAWA points out the environmental benefits of fuel savings, energy conversion efficiency, and reduced carbon dioxide production.

As discussed earlier, the benefits and disbenefits of the five options are compared using a simple additive weighting goal programming technique. Analyses of this type are only guides and at best can only rank options. Confidence levels cannot be determined when comparing tangible and intangible factors. The list of benefits/disbenefits (factors) identified by the programmer will significantly influence the final ranking. Economic, social and environmental objectives should all be considered equally, although this is often difficult to achieve.

Placing weighted values on factors involves a value judgement. Similarly, rating and ordering options when considering intangible factors can be considered as value judgements.

In response to the Draft EIS, 15 respondents (Table 1) indicated concern regarding the section on Alternatives. Comments can be grouped into two categories. Firstly, the number of feasible alternatives described, and secondly, the level at which the advantages and disadvantages of the options were analysed. These comments are summarised in point form below:

- . The alternative of using isolated solar installations at each settlement/development should have been addressed;
- . The gas pipeline option would require a narrower easement than the transmission line and there would be little adverse visual impact or obstruction above ground after rehabilitation and revegetation;

- . The feasibility of the different options should have been subject to a separate study;
- . The alternative of constructing the line underground rather than overhead, especially where the line crosses roads and traverses national parks, should be included;
- . Benefit/disbenefit factors should be weighted according to their relative importance in the total context of supplying electricity to the region;
- . The preferred option is based on economic grounds; environmental considerations are given insufficient attention;
- . PAWA does not consider new technology or the possibility of generating power in a more environmentally acceptable manner.

In conclusion, on economic grounds the transmission line is considered to be the best option, saving around \$20m over 30 years on the current situation (not including new mines).

With regard to the bio-physical environment there would be little difference between the pipeline and transmission option. In both cases safeguards can be applied to ameliorate adverse impacts.

The visual impact of the transmission line causes this alternative to be the least attractive with regard to social environment considerations.

2.2 Transmission Line Route Selection

Details on route selection are outlined on pp.26-31 of the Final EIS. The biophysical and social impacts associated

with the alternative route options are discussed in detail in Sections 3 and 4 of this report.

The proponent has provided three route options between Darwin and Kakadu National Park, and three options within Kakadu.

The options outside the Park are:

1. Channel Island - Arnhem Highway
2. Marrakai to Kakadu boundary (southern)
3. Marrakai to Kakadu boundary (Jim Jim)

and within the Park:

4. Arnhem Highway
5. Nourlangie
6. Jim Jim

All options have been assessed by the proponent using economic, engineering, bio-physical and social criteria. The option preferred by the proponent is the Jim Jim route from Marrakai to Jabiru (Figure 1).

The major disadvantages identified by the proponent with the Jim Jim route are:

- . it is longer and more expensive than the Nourlangie option;
- . it passes near Spring Peak and Mt Cahill;
- . the oblique crossing of the South Alligator River and Barramundie Creek;
- . it crosses the scenically attractive Jim Jim and Nourlangie Creeks; and

- . it passes a number of proposed tourist attractions, (the line however does not intrude on these sites).

The major advantages of the Jim Jim option identified by the proponent include:

- . it makes good use of natural screening and avoids crossing extensive areas of open sedgeland;
- . it minimises river and floodplain crossings;
- . tower and pole foundation conditions are in the most part excellent;
- . aesthetic impacts are considered to be more acceptable than the Arnhem Highway option; and
- . it is well situated to meet future power demands.

Several respondents to the Draft EIS (Table 1) expressed concern over the analysis of the transmission line route alternatives. The proponent has, in the Final EIS provided more specific route information and slightly modified the Jim Jim alignment. There were also a number of respondents who supported the Jim Jim alternative and the analysis provided by PAWA.

In conclusion, the comparison of the route options has been satisfactorily undertaken by the proponent. Subject to the transmission line being selected as the preferred power supply alternative, the Jim Jim option is recommended.

3. BIOPHYSICAL ENVIRONMENT, IMPACTS AND SAFEGUARDS

3.1 Introduction

This section reviews the descriptions of the existing biological and physical environments, the predicted impacts on these environments and the safeguards proposed to mitigate these impacts. The following factors are addressed:

- . flora and fauna;
- . soils/geology; and
- . watercourses/hydrology

The information provided in the Final EIS is assessed and then used along with submissions from advisory bodies and public comment on the Draft EIS to determine the adequacy of the information and acceptability of predicted impacts and safeguards. Specific recommendations for mitigation and monitoring of impacts are provided in the Recommendations section of this report.

Assessment focuses on the preferred option (132kV transmission line) and route (Jim Jim route). Discussion of the alternatives is included where relevant.

3.2 Flora and Fauna

Adequacy of Information

The Final EIS provides more thorough descriptions of existing flora and fauna than were contained in the Draft EIS, which was considered to be deficient in these areas by 10 respondents to the draft (Table 1).

The descriptions are, however, still very general, particularly for the fauna which does not appear to have been systematically ground-truthed and is by no means exhaustive considering the range of habitats and distance the power line traverses. Additionally, the significance of Kakadu National Park as a conservation area and World Heritage Site is not considered to be adequately reflected in the level of information on fauna within the National Park. The fauna appears to have been described from a combination of local knowledge, casual observation and existing data. Without more systematic investigation there are insufficient grounds for the statement that "no species of mammal, reptile or amphibian could be described as endangered in the vicinity of the proposed powerline" (p.47, Final EIS). Rare or endangered species of bird have not been considered. For example, the rare Red Goshawk which is now known to occur in the region and nests in tall trees adjacent to watercourses (David Baker-Gabb, pers comm), has not been mentioned.

While it is accepted that a quantitative fauna survey of the entire transmission line easement within Kakadu is not feasible, it is considered that more detail on existing fauna would be required to reliably predict the impacts of transmission line construction and operation.

The migratory patterns and seasonal movements of fauna, particularly birds, have not been investigated thoroughly enough for impacts of the line on these movements to be assessed. Potential movement corridors such as along the major watercourses of the Adelaide, Mary and South Alligator Rivers are dissected by the transmission line. The ANPWS and a private respondent noted this in comments on the Draft EIS; however, these points were not adequately addressed in the Final EIS.

There is no real assessment of alternative routes in terms of impacts on fauna. Apart from a general discussion on ecology, which emphasises the role of termites in Top End ecosystems, the existing fauna is described only for the preferred option. While it is obvious from the location map that alternative routes cross wetland areas which are known to be sensitive and rich in fauna, this is not discussed in the section on existing fauna (p.45, Final EIS).

Flora has been more systematically investigated with descriptions at 25 selected sites along the route. "No rare or endangered species were found during the (current) vegetation survey" and Top End endemic species were described as "relatively common and widespread within their distributions" (p.45, Final EIS). The assessment of alternative routes in terms of flora is considered to be adequate.

Despite the recommendations of several respondents to the Draft EIS, there has been no attempt to map environmental features such as vegetation or wildlife habitat in order to facilitate environmental assessment in the Final EIS.

Eight respondents to the Draft EIS (Table 1) advised on the need for the effects of regional power distribution within Kakadu National Park from the proposed transmission line to be examined as part of the EIS. The existing environment and likely impacts of the inevitable 22kV distribution system on that environment have not been described in the Final EIS. While the selection of the preferred route from Marrakai to Jabiru has emphasised the avoidance of sensitive wetland areas where visual impacts and risks of bird strike would be high, the EIS fails to consider the effects of the distribution system on these same areas, in particular the South Alligator floodplains near Kakadu Holiday Village.

Potential Impacts

The proposed transmission line will involve major clearance of vegetation in a 20-30m wide strip for the entire length of the line. During construction, access tracks, work and storage areas will also be cleared of vegetation. Smaller plant species will be permitted to regrow from seed or coppice after construction, but larger species will be controlled along the easement during routine maintenance once the line is in operation.

Clearance of any native vegetation is obviously deleterious from a flora conservation viewpoint, particularly in a World Heritage National Park. Any clearance of vegetation creates disturbance, not only to remaining plants, whose light, water, wind and competitive environments are modified, but to regenerating plants which may have to cope with the frequently associated problems of soil degradation such as erosion or compaction.

In addition, the disturbance created by vegetation clearance and vehicle traffic during construction will open a corridor for invasion by weed species. These species will be further spread by feral ungulates which will be attracted to the transmission line easement by the increased grass cover due to opening of the forest canopy, and for ease of movement from one area to another. A high proportion of respondents to the Draft EIS raised the invasion of weed species and plant diseases along this corridor as a significant potential impact and one which was not adequately dealt with in the draft (Table 1). Kakadu National Park currently has relatively very few weed species. The invasion of weeds into areas of Kakadu opened up by the transmission line easement, which are not already disturbed by roads or other infrastructure, would therefore be a serious incursion into the ecological integrity of the Park.

While the Final EIS mentions the potential invasion of weeds it does not discuss the significance of weed invasion on the conservation value of Kakadu.

Proposed safeguards to ameliorate these effects on flora are discussed below and in Section 8 of the Final EIS. Several impacts on flora will, however, be unavoidable and cannot be ameliorated if the proposal proceeds. These are the initial clearing of flora, and the permanent maintenance of a corridor effect. While a number of respondents to the Draft EIS raised these issues and indicated the impacts were unacceptable in a world heritage area, the Final EIS has made little attempt to directly address this aspect.

One of the most important effects of the proposed transmission line on fauna will be the disturbance of natural habitat. The impact of the proposal on fauna in the adjacent areas depends largely on the amount and type of vegetative cover remaining. For this reason it is likely that after initial clearing and prior to the anticipated regrowth of vegetation along the easement, the movements of small animals which avoid cleared areas will be disrupted.

Longer term impacts to animals such as the sugar glider, Petaurus breviceps, which requires trees at maximum intervals of 15-20m for a glide path, may include restriction of movement across the easement despite regrowth of smaller plant species, creating essentially two isolated populations with lower genetic diversity and long term viability. This conflicts with the objective of national parks to conserve species diversity and population viability. Furthermore, the altered habitat may promote species which would not normally occur in such areas, paving the way for altered predator/prey relationships, resource competition and breeding success. These issues, while raised by a number of respondents to the Draft EIS, have

been treated fairly cursorily in the Final EIS and finally dismissed with the comment that fauna habitats will be largely restored by the regenerative process. Complete restoration is not, however, possible while the transmission line is in operation.

A second impact of the proposed transmission line on fauna is the mortality of birds and bats colliding with the conductors. Seven respondents to the Draft EIS were concerned about this impact, which was addressed in the "List of Respondents and Comments attached to the Final EIS.

Overseas studies (Malcolm 1982, McNeil et al 1985, Faanes 1987) have shown that bird mortality from collisions with conductors can be quite significant for some species. The major factor in these collisions has been found to be the groundwire or earthwire, which is higher than and less visible than the conductors. Birds appear to see or sense the electrical field of the conductors, bank to avoid them and collide with the earthwire causing serious injury or immediate death.

The EIS states that the proposed route of the transmission line to Jabiru does not impinge on any significant Magpie Geese habitat and therefore the possibility of these birds striking the line is remote (p.82, Final EIS). There was, however, no assessment of migratory or seasonal movement patterns of these or any other species of bird in the Final EIS. While there is relatively little information on the major movement corridors of birds from one preferred habitat to the next, there is also insufficient information to state that the possibility of bird strike is remote. It is likely that the major river systems which the transmission line crosses are in fact important corridors for movement of birds and bats. Magpie Geese are likely to be particularly vulnerable to collision with transmission lines due to their frequently low altitude flight and limited manoeuvrability

in the air. Brolgas may also be at risk and are known to fly from breeding areas in the vicinity of the proposed transmission line to the coastal floodplains.

The Final EIS also states (p.82) that birds will not perch on conductors energised at voltages in excess of 66kV due to the field effect (which is also said to give birds warning of the conductor and presumably reduce strike rate). This is contradictory to another statement in the EIS that the powerlines may encourage predatory birds by providing vantage points for hunting (p.56, Final EIS) and the study by Faanes (1987) who observed birds perching on lines energised at 230-400kV.

It is therefore considered that the Final EIS has not adequately addressed the issue of potential bird mortality resulting from collision with conductors, particularly in relation to Kakadu National Park.

A third impact on fauna which was raised by two respondents to the Draft EIS (Table 1) was the potential for exotic and pest insects and other pest introduction and establishment in the disturbed easement. Exotic species of ants, for example, may be easily transported to such areas, and can rapidly colonise and out-compete native species in disturbed areas. The Final EIS does not address this potential impact.

Safeguards

The safeguards intended to minimise or mitigate environmental impacts on the flora and fauna are listed in Table 2 of this report and discussed in Section 8 of the Final EIS. The location of the preferred route has been selected, in part, to avoid sensitive habitats and therefore minimise environmental effects. Of the three alternative routes presented the preferred route does appear to achieve this best.

The construction guidelines (Section 8.2, Final EIS) give the most detailed outline of proposed safeguards. These guidelines advocate minimal disturbance and clearing of vegetation to the extent possible given that a minimum easement width, work areas and access roads are required. The construction guidelines, if adhered to, will ensure that impacts on the biological environment are minimised and improve upon the safeguards given in the Draft EIS, which at least five of the respondents considered inadequate (Table 1).

There are a number of areas however, where safeguards relating to flora and fauna could be clarified or improved, particularly for operations within Kakadu.

Permission to clear trees and vegetation to prevent the spread of bushfires in an emergency (p.67, Final EIS) may create problems, particularly within Kakadu. Any clearing in an emergency would have to be done rapidly and, if one was nearby, would presumably involve a bulldozer. Problems may arise as to how capable the person in charge at the time is of identifying an emergency, and how much area he/she considers it is necessary to clear to divert that emergency. All work crews should carry sufficient fire fighting equipment to put out any fires which they might accidentally start, thus minimising any necessity for clearing in an emergency. Preferred fire fighting practices should be established with ANPWS before operations commence in Kakadu.

The Bushfires Council of the NT has advised that the owner/operator of the transmission line should contact them prior to clearing to arrange controlled burning of the easement to be cleared. This will reduce the risk of fires being started accidentally and may improve the line of sight for surveying, reducing the need to bulldoze a survey line.

The installation of any culverts or bridges should ensure that these do not create any impediment to the movement of fish, even in the case of temporarily flowing creeks. Any vertical drops from the culvert to the creek bed can form a physical barrier to fish migration. The Project Environmental Officer should therefore inspect all such installations to ensure they meet criteria acceptable to DPIF, Fisheries Division.

Prior to hand-clearing of vegetation on either side of creek or river crossings the Environmental Officer should inspect the trees to be felled for bird nests, particularly those of the Red Goshawk. Recent studies have shown that this rare species frequently nests in tall trees in close proximity to waterways. The nests are relatively large and conspicuous. Within Kakadu National Park location of any such nests should be reported to ANPWS prior to felling of the tree. Outside the Park such reports should be directed to CCNT.

The safeguards to prevent weed infestation of the transmission line easement, particularly within Kakadu, should be strictly adhered to. While Mimosa is controlled within Kakadu, Hyptis is not and there is some doubt by several respondents as to whether "routine" inspections once or twice per year (p.78, Final EIS) would be adequate to locate and control the spread of this and other weeds along the easement. Mimosa is unlikely to create severe problems because the easement does not traverse any large areas of suitable Mimosa habitat.

The undertaking for long term inspection and control of weeds along the easement appears to lack some commitment in statements under the Operations Section 8.3 (p.78, Final EIS). "Monitoring for the introduction and spread of introduced species ... should be undertaken" and "detection

of new weed infestations or spread of existing species **should** be followed with appropriate control." Previous undertakings in the EIS that weeds **will** be detected and controlled should be adhered to by the operator in the long term, not just immediately post construction.

Rehabilitation practices outlined in the Final EIS and summarised in Table 2, appear to be adequate for the successful re-establishment of flora and fauna in disturbed areas. In the case of seeding with introduced pasture species to stabilise soils in areas which do not readily revegetate naturally (p.77, Final EIS), it is advised that ANPWS and CCNT be consulted prior to such works being undertaken in Kakadu National Park and Mary River Station Block respectively. In all cases, where possible, it would be preferable to use native species for rehabilitation, including tree and shrub species so that native vegetation is not simply replaced by grass. Grass species are useful for short term soil stabilisation, but do not create habitat suitable for many types of fauna, compared with the diverse habitats of native forest.

3.3 Soils and Geology

Adequacy of Information

The Final EIS provides more adequate descriptions of soils and geology than were contained in the draft. Most detail is provided for the preferred option which appears to be the most suitable in terms of soils and geology. Alternative routes are largely unsuitable due to the large expanses of alluvial floodplain which would be traversed by the transmission line.

Potential Impacts

There are unlikely to be any impacts from the proposal on geology. Soils are more likely to be disturbed through construction operations and any subsequent erosion. Nine respondents to the Draft EIS (Table 1) considered that the potential for soil erosion from the proposal was inadequately dealt with. The Final EIS addresses this issue more fully and acknowledges that one of the major potential physical impacts of the proposal is soil disturbance and erosion.

Some disturbance to soils is unavoidable given the need for clearance of easements and work areas, excavation for tower foundations and construction of access roads. Of particular concern is the soil structure along watercourses which can be the source of severe erosion problems if disturbed, affecting not only the terrestrial systems but the aquatic ecology by silting-up habitats and reducing water clarity.

Safeguards

The preferred route has been aligned to avoid steep slopes or other highly erodible soils or landforms, thus route selection is one of the major factors in the minimisation of disturbance to soils. Considerably more attention to safeguards to reduce soil disturbance and erosion has been given in the Final EIS than in the draft. Safeguards relating to clearing and construction practices including top soil management, rehabilitation of roads, clearings and borrow pits, soil and weed hygiene and erosion control and prevention have been well documented in the Final EIS and are summarised in Table 2. If these safeguards and construction guidelines are adhered to the potential effects of soil disturbance and erosion are considered to be minimal.

An important factor in the success of safeguards to minimise impacts on soils will be the commitment to long term follow-up, such as rehabilitation of areas which do not readily revegetate or are subject to continuing erosion as a result of transmission line construction. The role of PAWA in ensuring that the owner/operator undertakes this work should be clearly defined (p.78, Final EIS). PAWA should have a continuing involvement in this aspect for the life of the transmission line. Within Kakadu National Park and MRSB there should be contractual provision for park managers to notify PAWA and/or the operator of any soil erosion problems associated with the transmission line and request prompt remedial action.

3.4 Watercourses/Hydrology

Adequacy of Information

The hydrological features of the proposed transmission line route have received greater attention in the Final EIS than in the draft. The major watercourses in the transmission line corridor are the Adelaide, McKinlay, Mary and South Alligator Rivers. Numerous smaller rivers and creeks are also traversed by the route.

The alternative routes to the preferred route also traverse most of these watercourses; however, each of the alternatives involves crossing over the alluvial floodplains of the major rivers which would detract from their aesthetic qualities, be engineeringly more difficult, and increase the risks to fauna, particularly birds, in the floodplain habitats.

Potential Impacts

Potential impacts of transmission line construction and operation on hydrology have been dismissed in the Final EIS

as unlikely. The Final EIS fails to note that disturbance to the catchment of a watercourse, such as clearing of vegetation, can produce a change in water quality even if hydrological patterns are little changed. The comment on potential water pollution by a respondent to the Draft EIS (Table 1) was therefore not addressed in the Final EIS. Silt loads in runoff from newly cleared areas will inevitably be higher than for vegetated catchment areas. Increased silt loads can adversely affect aquatic biota, particularly in streams which normally carry low suspended sediments. The larger river systems in the Top End tend to have naturally very high suspended sediments but some of the smaller watercourses have quite clear water.

Potential impacts of the 22kV distribution system within Kakadu National Park, on hydrology, have not been addressed. While the preferred 132kV route has been selected to avoid impacts on the floodplains of the major river systems, the impacts of the proposed 22kV transmission line on these same systems has been largely ignored.

Safeguards

In general, the safeguards proposed to minimise disturbance to watercourses from transmission line construction (Table 2), such as hand clearing of riparian vegetation within 50m of a waterbody, are considered to be adequate if correctly adhered to. Soil erosion control and prevention along the entire transmission line easement (Section 8, Final EIS; Section 3.3 this report) will also greatly contribute to the reduction of potential effects on water quality.

Prompt action to actively rehabilitate or revegetate problem areas in close proximity to watercourses will help to minimise effects on water quality.

3.5 Conclusions

In conclusion, while the Final EIS has addressed many of the issues relating to the biophysical environment raised by respondents to the Draft EIS, the adequacy with which these have been dealt with varies and some important omissions are still apparent.

Perhaps the major omission is adequate discussion of a point raised by half the respondents to the Draft EIS (Table 1) and that is the impact of the transmission line on the world heritage value of the biophysical environment of Kakadu National Park. While the proponent has gone to some lengths to minimise the impacts on the biophysical environment along the entire length of the transmission line, some level of impact is inevitable.

A further omission which was also raised by respondents to the Draft EIS relates to the impacts of the 22kV distribution line on the biophysical environment within Kakadu, which will inevitably occur if the proposal proceeds. These have not been addressed and no safeguards have been put forward in the Final EIS.* The cumulative impact of this inevitable further development should have formed part of the overall project assessment.

The Final EIS also continues to inadequately describe fauna, particularly within Kakadu. In view of this lack of detailed information on the fauna occurring along the proposed route, the best means of protecting the fauna is by protecting the habitat, namely the soils and vegetation. It is considered that the safeguards proposed to achieve this are adequate, given that some impact is unavoidable if the proposal proceeds, and provided that there is adequate commitment to these safeguards in the long term. The role of PAWA in ensuring that safeguards to minimise impacts on the biophysical environment are met by the owner/operator to

the satisfaction of the landowner/manager (including ANPWS) should continue for the life of the transmission line and be clearly stated in contractual arrangements with the owner/operator.

4. SOCIAL ENVIRONMENT, IMPACTS AND SAFEGUARDS

4.1 Introduction

This section of the assessment report reviews the adequacy with which the social environments were examined in the Final EIS, particularly in regard to the potential impacts that are predicted to result from the proposal. A discussion of the safeguards proposed as a means of minimising or avoiding adverse environmental effects is also presented.

Matters covered within this section are dealt with under the headings:

- . national parks and tourism;
- . mining;
- . private and pastoral land use;
- . Aboriginal interests; and
- . sites of importance.

The review is based on an examination of the Draft EIS, comments provided on the Draft EIS by the public, Northern Territory advisory bodies, and Commonwealth Government authorities, and the responses to these comments and further information included in the Final EIS by the proponent.

4.2 National Parks and Tourism

Approximately 50% of the transmission line (or 110km) will be located within existing and proposed publicly reserved lands. Assessment of the Draft and Final EIS's has revealed

that insufficient attention has been given to some effects of the impacts of the powerline proposal on these areas.

Kakadu National Park

Several key issues relating to the impact of the transmission line on Kakadu National Park were identified during the review. These included:

- . concern, particularly by conservation groups, that the transmission line would be incompatible with the National Park and its world heritage values;
- . concern that the proposal would not be in accord with the existing Kakadu National Park Plan of Management;
- . the lack of detailed environmental assessment of the proposed 22kV distribution system; and
- . insufficient attention to the visual and aesthetic impact of the line.

The issue of aesthetic impact is discussed under the subsection on tourism - other issues are considered below.

Twelve respondents to the Draft EIS (Table 1) asserted that the line would be incompatible with the world heritage value of Kakadu National Park, or would compromise the quality of the Park environment. This philosophical concern arises from the biophysical and aesthetic impacts that the transmission line could be expected to have and the belief that the line cannot be viewed as being essential for park management purposes. Rather, many respondents have perceived that the transmission line would further open-up the Park for tourism, mining and other development.

ANPWS expressed concern over the impact of the line on the Park and questioned the appropriateness of the proposal. The ANPWS submission also quotes from the Draft EIS that, "... Powerlines are antithetical to such experiences (encountering a pristine landscape). Powerlines are part of what city people come to Kakadu to escape from".

A related concern expressed by some conservation groups and ANPWS was that construction of a transmission line, and associated distribution system, would be contrary to the management objectives of Kakadu National Park, as outlined in the Plan of Management. ANPWS stated that "an above ground regional network of transmission lines does not accord with the Management Prescriptions outlined in Section 17.6.2 of the Plan of Management which state:

So far as practical power and water supplies should be contained within the site of new developments, be designed for minimal environmental impact and be laid under ground.

The Final EIS has not adequately responded to either of these issues concerning the appropriateness of the proposal to national park values, or compatibility of the proposal with existing Plan of Management provisions.

Another major criticism of the Draft EIS, concerns the lack of examination of the proposed regional 22kV distribution system. This issue remains inadequately addressed in the Final EIS. It is considered that examination of the environmental effects of the proposed transmission line should have included a similar evaluation of any secondary distribution system.

Both the Draft and Final EIS have concentrated on the physical impacts of the construction of the powerline on the

Park. Such physical impacts include soil erosion, habitat degradation, noise and vibration, and indirect effects such as those associated with construction camps (health and waste disposal issues, social impact on tourist facilities, etc). The Final EIS states that long-term post construction impacts on the natural environment will be low and the adoption of appropriate environmental safeguards (such as scalloped clearing techniques and stringent weed control) will minimise impacts on the Park environment. While the cumulative affect of constructing the 132kV transmission line is acknowledged, the proponent states that correct rehabilitation of the line will minimise longer term impacts. This conclusion does not take account of the long-term aesthetic impact of the transmission line.

Safeguards have been developed, however, to minimise visual and aesthetic impacts particularly in environmentally sensitive areas such as the Mt Cahill area and Jim Jim Creek Crossing. In both areas the Final EIS indicates that the route has been chosen to ensure minimal visual impact. Attention has also been given to aesthetics in areas where the powerline will cross the Kakadu Highway. The proponent has also stated in the Final EIS that safeguards developed to protect Park values will include:

- . the use of poles to create a low profile section of the powerline where the line can be viewed from escarpment vantage points;
- . contingency for a second circuit to be attached to the line in the event that power is needed in future at Cooinda;
- . guyed pole construction has been proposed to minimise visual impact for road travellers;
- . careful design of pole spacings near roads;

- . non-specular conductors have been specified for Park areas.

A complete list of environmental safeguards is included in Table 2 of this report.

Benefits to Kakadu National Park arising from the transmission line are listed in the Final EIS as including: a robust and reliable electricity supply; a reduction in the number of road tankers on the Arnhem Highway and therefore a reduced risk of oil spills; and a possibility of powered sites at Kakadu camp grounds, replacing the use of personal generators, and allowing the provision of electric barbeques and other facilities.

Not all of these benefits have been quantified - for example ANPWS has indicated that power will not be needed for camp grounds in Kakadu, and there is no indication of the real risk of oil spills from tanker accidents.

McKinlay River Station Block

The Final EIS has noted the acquisition by the NT Government of land on the McKinlay River. Part of this land is intended for reservation for conservation of fauna. Little attention is given to the conservation and recreation values of this area in the Final EIS, nor to the impacts the powerline will have on future land use. It is stated that the powerline will cross the narrowest section of the McKinlay River floodplain and it has been estimated that approximately 5km will be affected. The proposed routing of the line will impact on users of the acquisition area.

Safeguards to be implemented to minimise environmental impacts include:

- . the use of non-specular conductors and guyed lattice poles;
- . careful location of poles to minimise the number of spans needed to cross the floodplain;
- . liaison with the Conservation Commission in order to minimise damage.

Tourism

The major tourist destination in the Darwin region is Kakadu National Park and so many of the issues raised above in relation to national parks will also apply to some degree to tourism. The Draft EIS emphasised the large exponential growth in tourism that has occurred in Kakadu in recent years and provided a basic analysis of tourism in the region including; the origin of tourists, the nature of their activities, an outline of visitor statistics (age, mode of travel, etc), and a brief description of tourist accommodation facilities. Impacts on tourism were discussed in very general terms with construction activity predicted to lead to increased traffic movements along Jim Jim road and temporary access tracks into construction areas. The major long term impact of the transmission line on tourists was predicted to be visual, but this was described as a "trade-off" between improved services and a "wilderness" image. Several submissions made during the review of the Draft EIS were critical of this analysis. In particular, although the growth of tourism in Kakadu has been exponential in the past, it was asserted that this pattern may not be sustained indefinitely. It was also felt that it was unreasonable to presume that there is an almost infinite pool of potential visitors to Kakadu.

Specific comments were made about the impact of the line on the Mt Cahill look-out. It was claimed that the line

easegment along the Kakadu highway would be very visually intrusive. In response, the Final EIS has stated that the transmission line has been located so that it is not visible from Mt Cahill look-out and that sectional views through Mt Cahill, the Kakadu Highway and the transmission line route have been prepared to demonstrate this. Perspective views have also been included to demonstrate that the transmission line will be only of limited visibility from the old Jim Jim road.

Other comments made on the impact of the transmission line on tourism include an observation that the line would be particularly visible from scenic flights. This point is accepted by the proponent; however, it is proposed to implement environmental safeguards such as scalloped clearing techniques, to break up the linearity of the route clearing.

General comments were made by a number of reviewers on the visual impact of the transmission line and its effect on the wilderness experiences of the visitor, while others commented on the fact that only the non-camping minority of visitors will benefit to any significant extent from the powerline project. These comments are not addressed in the Final EIS; however, the document does indicate the substantial benefits that will arise from the transmission line, including:

- . electricity supplies will be improved for tourist infrastructure including commercial facilities at Jabiru and the Cooinda Motel; and
- . the line provides ANPWS with an opportunity to provide powered camp sites at strategic locations.

4.3 Mining

Much of the justification of the powerline proposal hinges on mining activity, current and proposed, in the region. The Draft EIS identified mining, along with tourism, as the primary cause of the very rapid change that is occurring in the Alligator Rivers Region, that "will dictate a need for rationalisation of the region's electricity supply system to meet increases in demand". It is clearly stated in the Final EIS that "commercial viability of the transmission line project is dependent upon the ability of the Power Directorate to sell its electricity to Ranger Uranium Mines Pty Ltd".

Several comments made during the review of the Draft EIS were critical of the reliance of the powerline proposal on future expansion of mining in the region. Major concerns were that justification was speculative and it was considered that the decision to proceed with the powerline should not be made until mining options are clearer. Doubt was also expressed over the use of power from the line by Jabiluka and Koongarra proposed mines. These issues have not been explicitly addressed in the Final EIS. In the Final EIS PAWA has indicated that Ranger has agreed in principle to purchase electricity, delivered by the transmission line. Sales to RUM and Jabiru therefore ensure viability of the transmission line. The RUM Agreement, however, is subject to final agreement on commercial details and approval by the RUM Board.

4.4 Private and Pastoral Land Use

The preferred route for the proposed transmission line will traverse three pastoral leases; Koolpinyah, Kerlin Pastoral Company Lease, and Mt Bunday, and will pass to the north of the proposed Mt Bunday Department of Defence field training area. The Final EIS indicates that pastoralists have no

objections to the powerline proposal. No public submissions were made by pastoralists commenting on the impact of the line on pastoral leases.

The Final EIS identifies the potential hazard of the line on aerial mustering activities as the major impact. Other impacts will be similar to those identified and discussed elsewhere in the Draft and Final EIS's and this report; that is, potential for habitat degradation, soil erosion, and noise from construction activities and modified ecological conditions and permanent visual impacts due to the presence of the line in the long term. These impacts and safeguards to minimise them are summarised in Table 2.

The alignment of the powerline has been designed to skirt the designated Mt Bunday military firing range and should not impact on the activities of this landuse. No public comments or government submissions were made commenting on this issue.

4.5 Aboriginal Interests

The examination of Aboriginal interests with regard to the transmission line in the Draft EIS was considered to be inadequate by eight respondents (Table 1). In particular, the fact that the route traverses significant areas of land granted under the Aboriginal Land Rights Act and areas on and off Aboriginal land that are currently utilised by Aboriginal people for food gathering or cultural activities were considered not to have been adequately discussed in the draft.

The Final EIS concerns itself primarily with Aboriginal Sacred sites, of which none were found by ASSPA to occur along the proposed route. Arrangements for Aboriginal custodians to accompany construction crews during easement

clearing as a final precaution against inadvertent damage to sites have been agreed to by PAWA. This agreement should be formally included in the contractual arrangement between PAWA and the owner/operator of the transmission line. General safeguards for protection of Aboriginal sacred and significant sites as included in the Construction Guidelines of the Final EIS (p.66) appear to be adequate.

Other Aboriginal interests have received limited attention in the Final EIS. The Final EIS claims that the transmission line will be beneficial for Aboriginal interests by:

- . extending electricity supply to Gunbalanya;
- . providing stable electricity supply for commercial interests such as the Aboriginal-owned Cooida resort;
- . drawing development pressure away from pristine resources and concentrating it beside the 22kV system;
- . improving potential for the extension of tourist activity into Arnhem Land as an Aboriginal enterprise.

These claims do not accord with the comments submitted by the Northern Land Council on the Draft EIS, that:

- . "current arrangements regarding power needs for Jabiru and other visitor accommodation are adequate and will remain so for the duration of the present ANPWS Plan of Management for Kakadu;
- . the proposal affords no significant benefit to traditional Aboriginal owners; and
- . there is potential for the transmission line to cause substantial detriment through the diminution of essential values of Kakadu National Park".

The preferred route is more appropriate in terms of Aboriginal interests than alternative routes, particularly the Nourlangie option, in that the impacts on the South Alligator River floodplain, of major importance to Aborigines, are less. The impacts of the distribution system on Aboriginal interests in these and other areas have not been assessed.

4.6 Sites of Importance

Significant sites other than Aboriginal sacred and significant sites were identified in the Final EIS by reference to the CCNT Conservation and Recreational Priority Sites Register. Most of the sites found to occur along the preferred route related to recreational activities, in particular fishing, hunting, camping, bushwalking and orienteering. Construction practices designed to minimise effects on the biophysical environment (Section 3 of this report) will ensure that physical impacts on these sites are also minimised. The unavoidable visual impacts on these sites, however, have not been discussed in the Final EIS. Visual impacts on these types of activity are likely to be high given that they are primarily based on recreation in natural or wilderness areas.

The old Jim Jim Motel located at Jim Jim Creek, will also be visually impacted by the transmission line, which will pass within about 50m of the building. The Final EIS does not assess how visually intrusive the transmission line will be on this site, which is currently used as a backpacker's hostel. In addition, it does not discuss any measures which may be used to reduce the visual impact of the line at this site, such as screen planting of native vegetation, camouflage painting of towers or relocation of the line.

The only other significant sites along the route relate to important or unusual flora and fauna, as well as the significance of the regional ecology of the Alligator Rivers Region. The location of Brolga breeding sites on the Adelaide, Margaret and McKinlay 'Rivers' floodplains, traversed by the preferred option, suggest that there may be some risks associated with these birds striking the transmission line. This has been discussed in section 3.2 of this report.

Specific safeguards have not been developed for these significant biological sites; however, they will largely be protected by safeguards intended to protect flora and fauna in general.

The proponent has undertaken to notify appropriate authorities, through the Project Environmental Officer, if any historic relics or archaeological material is located during construction or operation. These will then be appropriately dealt with according to advice from the relevant authority.

In terms of significant sites the preferred route (Jim Jim route) appears to have fewer problems than the Arnhem Highway option, which would impact on a number of significant floral, faunal and recreation areas. There is no discussion of significant sites for the Nourlangie option in the Final EIS; however, this option can largely be excluded on the basis of significance to Aborigines.

4.7 Conclusions

The review of the Draft and Final EIS and analysis of public comments has revealed that the major social impact of the transmission line proposal will be on Kakadu National Park. Major concerns arising from the public review were found to be philosophical, involving questions of the compatibility

of the proposal with park values and the Kakadu National Park Plan of Management, and aesthetic, concerning the visual impact of the transmission line in certain areas. The Final EIS has not addressed the philosophical concerns adequately; however, the document proposes a number of safeguards to reduce the visual impact. Through careful line location and selection of appropriate support structures, visual impact of the line will be minimised. The Final EIS has also concentrated on the development of safeguards to minimise or avoid impacts on the biophysical environment. A number of beneficial impacts arising from the transmission line have been identified; however, it is arguable whether these would outweigh the other less favourable impacts on the National Park.

The proposal is expected to have little adverse impact on other land uses, particularly pastoralism, although assessment has shown that future mining in the area could benefit from a reliable power source, provided by the transmission line.

Safeguards relating to the protection of Aboriginal sacred sites appear to be adequate. The wider issues of Aboriginal concern have received limited attention.

5. GENERAL CONCLUSIONS

The results of this review, based on the conclusions identified in Sections 2, 3 and 4, are summarised as follows:

- . the visual and aesthetic impacts of the transmission line, particularly within Kakadu National Park, and the need for a transmission line are the main issues associated with the proposal;

- . one of the proponent's main justifications for the proposal, that a transmission line connecting the Alligator Rivers Region to the Darwin-Katherine distribution system will improve the viability of the Channel Island Power Station is accepted; however, the Final EIS has not conclusively demonstrated any new demand to support the proposal;
- . based on economic analysis of the five alternative power supply options, the proponent's selection of the transmission line as the preferred option is supported;
- . while the Final EIS has addressed many of the issues relating to the biophysical environment raised by respondents to the Draft EIS, the adequacy with which these have been dealt with varies and some omissions remain in particular, the impact of the transmission line on the world heritage value of Kakadu National Park has not been fully examined and the cumulative impact of the proposed 22kV regional distribution system has not been addressed;
- . comparison of the five alternative power supply options on biophysical criteria indicates that the existing power supply situation is the best option in terms of environmental impacts. The transmission line, however, is marginally preferred to the gas pipeline option and is preferred ahead of the remaining options;
- . examination of the route selection analysis on biophysical criteria supports the proponent's conclusion that the Jim Jim route is the preferred option for the transmission line;
- . although the impact of the transmission line on local fauna is considered to have been inadequately addressed in the Final EIS, particularly within Kakadu National

Park, the safeguards proposed by the proponent to protect habitat are generally considered to be adequate;

- . the safeguards relating to clearing and construction practices for the transmission line have been well documented in the Final EIS and, with some additions identified as part of this review, are considered to be comprehensive. If these safeguards are adhered to the effects of soil disturbance and erosion are expected to be minimal;
- . the main disadvantage of the transmission line is its visual and aesthetic impact, particularly in relation to Kakadu National Park. The proponent has attempted to minimise these impacts by means of the route selected, construction safeguards and other measures proposed to be implemented. The transmission line will be located, for the most part, 200m from roads and should not be easily obvious to travelling tourists. Measures have been proposed by the proponent to minimise the visual impact of the line along the route and from scenic lookouts and tour flights;
- . the aesthetic impact within an area such as Kakadu National Park is difficult, if not impossible, to quantify and will to a large extent depend on minimising the visual impact of the transmission line in sensitive areas. Some impact will be inevitable, but it could be argued that existing access roads and tourist developments already impinge on the natural values of the Park. Roads and accommodation are taken for granted by tourists as being necessary developments in order to experience the attractions of the Park. Whether a similar conclusion can be drawn for ancillary facilities such as a transmission line, provided the development is undertaken in an environmentally

sensitive manner, is a decision for the Park managers and the Government;

- . the transmission line is expected to have little adverse impact on other land uses such as pastoralism and mining, and is more likely to be beneficial for these industries; and
- . no Aboriginal sacred sites have been identified along the proposed route by the Aboriginal Sacred Sites Protection Authority and the route is likely to be the most acceptable option in terms of Aboriginal interests. Procedures for consultation with Aboriginal custodians during survey and clearing of the final alignment are in place.

6. RECOMMENDATIONS

Subject to decisions which will permit the proposal by the Northern Territory Power and Water Authority to construct a 132kV transmission line between Marrakai and Jabiru to proceed, the following environmental safeguards and conditions should be adopted:

1. The proponent is to ensure that the proposal is implemented in accordance with the environmental undertakings, guidelines, conditions and safeguards identified in the Final Environmental Impact Statement: Marrakai-Jabiru 132kV Transmission Line, November 1988 (PAWA).
2. The proponent is to ensure that the construction contractor and the owner/operator adhere to all of the environmental safeguards specified in Table 2 of the Marrakai-Jabiru 132kV Transmission Line Environmental Assessment Report, December 1988, (CCNT).

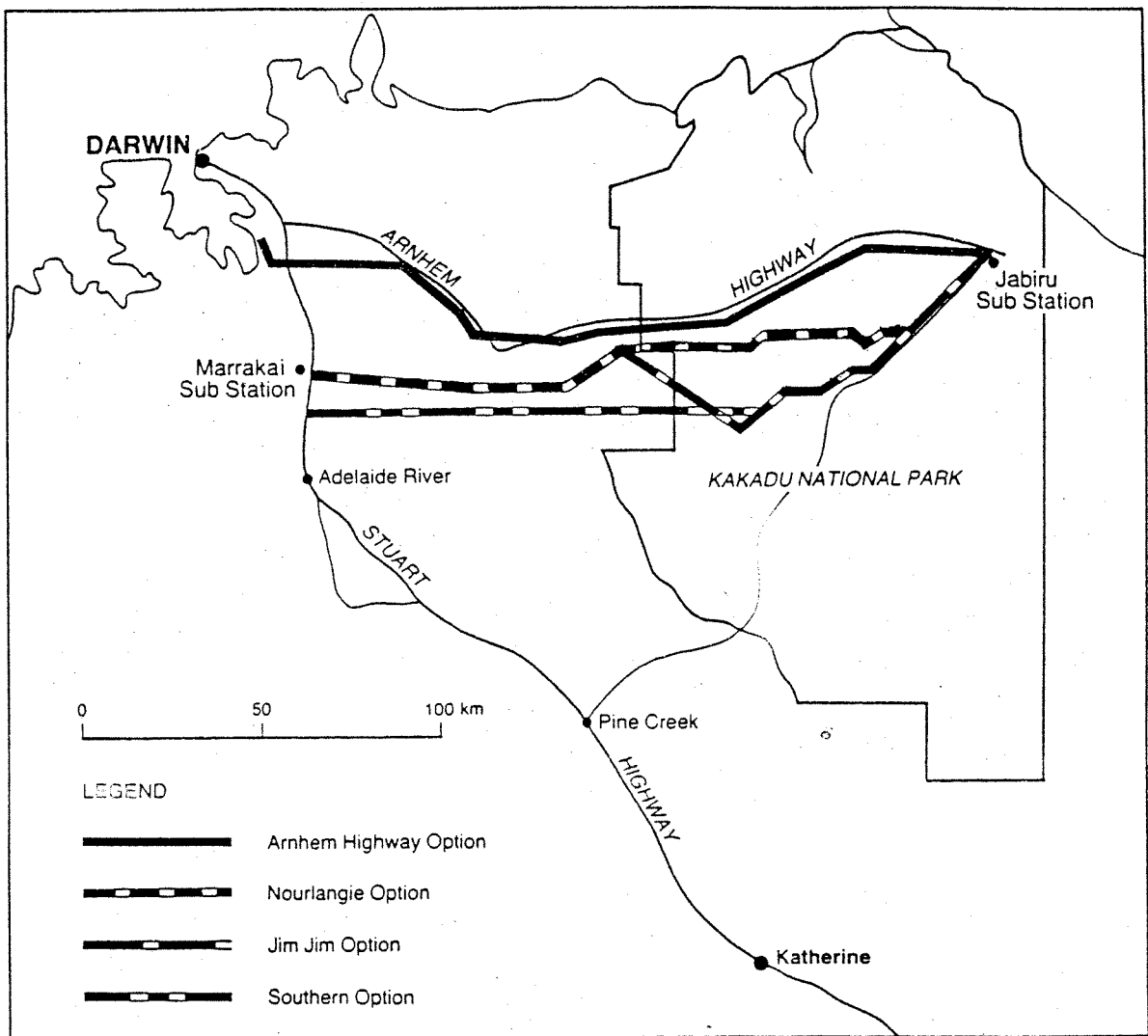
3. The proponent is to undertake to provide supplementary information on the proposed 22kV regional distribution system to CCNT and DASETT for consideration, following consultation with ANPWS and Aboriginal custodians.
4. The proponent is to provide CCNT with the details of the final alignment of the 132kV transmission line agreed in consultation with the ANPWS, Aboriginal custodians and other affected landholders.
5. The proponent is to provide the construction contractor with maps and/or aerial photographs (1:25000) on which sites for support structures and the location of sensitive areas have been identified.
6. The Project Environmental Officer is to be on-site to supervise and enforce environmental safeguards for construction activities at all sensitive areas.
7. The proponent is to provide CCNT with baseline information on the occurrence of noxious weeds along the proposed route, using 1:25000 aerial photographs.
8. The proponent is to ensure that approval is obtained from CCNT (and ANPWS within Kakadu National Park) prior to creating access tracks to the transmission line easement.

REFERENCES

Faanes, C.A. (1987) Bird Behaviour and Mortality in Relation to Power Lines In Prairie Habitats. United States Department of the Interior, Fish and Wildlife Service. Fish and Wildlife Technical Report No. 7.

Malcolm, J.M. (1982) Bird collisions with a power transmission line and their relation to botulism at a Montana wetland. Wildl. Soc. Bull 10:297-304.

McNeil, R., J.R. Rodriguez and H. Ouellet (1985) Bird mortality at a power transmission line in north eastern Venezuela. Biol. Conservation 26:155-165.



**FIGURE 1 - LOCATION MAP
(Transmission Line Route Alternatives)**

(Source - "Marrakai-Jabiru (NT) 132kV Transmission Line"
Environmental Impact Statement)

SUMMARY OF RESPONDENTS
COMMENTS ON THE DRAFT EIS

ISSUE / COMMENTS	ORGANISATION	DASETT	ANPWS	PAWA - WATER	NLC	TAS. CON. TRUST. INC.	CON. COUNCIL. SE. (CANBERRA)	QLD. CONS. COUNCIL	AUS. PEOPLES REP. COUNCIL	BIG SCRUB ENV. CENTRE	TOTAL ENV. CENTRE SYDNEY	CONS. COUNCIL SA	THE WILDERNESS SOC. VIC.	AUS. HERITAGE COM.	AUST. CONS. FOUND.	ENV. CENTRE NT. INC.	THE WILDERNESS SOC. NSW.	DEPT T&W ROADS. NT.	ASSPA	CCNT	DEPT. HEALTH & C. SERVICES	NT MUSEUM	DME - MINES	DID	J.L. SMITH - (JABIRU)	P. BLACKWELL - (TASMANIA)	TIM DEVLIN - (VICTORIA)	GEOFFREY CROKE - (VICTORIA)	TOTAL
Inadequate justification; (power demand, uncertainty).		*	*		*	*	*		*	*	*	*	*	*	*	*	*	*	*	*					*	*	*	*	16
Economic viability questioned.			*			*	*			*	*	*	*	*	*										*	*	*	*	9
Security of power supply of preferred option questioned.			*										*	*	*	*									*	*	*	*	5
Regional growth and tourism forecasts queried.		*	*																*										3
Lack of consideration to alternative power sources.		*	*			*	*			*	*	*	*	*	*	*	*	*	*	*					*	*	*	*	15
Lack of consideration to advantages and disadvantages of each proposed alternative.		*	*	*						*	*	*	*	*	*	*	*	*	*	*					*	*	*	*	14
Preferred route questioned (corridor).			*						*	*	*	*	*	*	*				*										6
Project description inadequate (incomplete design and construction) details.			*						*			*						*	*	*									5
Regional power distribution.		*	*						*	*	*	*	*	*	*	*	*	*	*	*									8
Costs of options unclear (no mention of environmental costs in table 3 and 4).			*				*										*	*	*	*					*	*	*	*	6
Social-environment assessment inadequate (table 5 misleading).							*			*					*	*	*	*	*	*									5
Document does not satisfy legislative requirements.														*	*	*	*	*	*	*									2
Baseline description of flora and fauna inadequate (impact description poor).		*	*			*				*			*	*	*	*	*	*	*	*	*				*	*	*	*	10
Impact description inadequate on fauna and flora (particularly on birds and bats).		*	*	*						*			*	*	*	*	*	*	*	*					*	*	*	*	7

ISSUE / COMMENTS	ORGANISATION																												
	DASETT	ANPWS	PAWA - WATER	NLC	TAS. CON. TRUST. INC.	CON.COUNCIL.SE. (CANBER)	QLD. CONS. COUNCIL	AUS. PEOPLES REP. COUNCIL	BIG SCRUB ENV. CENTRE	TOTAL ENV. CENTRE SYDNEY	CONS.COUNCIL SA	THE WILDERNESS SOC. VIC.	AUS. HERITAGE COM.	AUST. CONS. FOUND.	ENV. CENTRE NT. INC.	THE WILDERNESS SOC. NSW.	DEPT T&W ROADS. NT.	ASSPA	CCNT	DEPT. HEALTH & C.SERVICES	NT MUSEUM	DME - MINES	DID	J.L. SMITH - (JABIRU)	P. BLACKWELL - (TASMANIA)	TIM DEVLIN - (VICTORIA)	GEOFFREY CROKE - (VICTOR)	TOTAL	
Visual impact inadequately addressed (tourist flights, lookouts, scenic areas).	*	*		*	*	*	*		*	*	*	*		*	*	*		*							*				15
Wilderness quality reduced (incompatible with World Heritage values).		*		*	*	*			*	*	*	*			*	*	*								*				12
Lack of consultation and documentation of traditional owners comments (no benefit to Aborigines).		*		*					*		*	*	*		*			*											8
Lack of consideration given to Aboriginal Sacred Sites.																		*											1
Falls to address cultural/archaeological concerns.		*										*						*											3
Impact on national heritage sites poorly addressed.												*																	1
Tenure of powerline easement unclear.		*																*											2
Contradicts Kakadu Plan of Management.		*		*			*			*	*	*		*	*	*		*									*		11
Sub-divides Park by new corridor.		*								*															*				3
Land alienation 450 ha.		*																											1
Fire hazard inadequately addressed (no safeguards outlined).									*	*	*	*			*	*				*					*	*			9
Weed invasion, insect invasion, and soil erosion not detailed adequately.					*	*			*	*	*	*			*	*									*	*			9
Water pollution hazard questioned.						*																			*				2

ISSUE / COMMENTS	ORGANISATION																
	DASETT	ANPWS	PAWA - WATER	NLC	TAS. CON. TRUST. INC.	CON. COUNCIL. SE. (CANBERRA)	QLD. CONS. COUNCIL	AUS. PEOPLES REP. COUNCIL	BIG SCRUB ENV. CENTRE	TOTAL ENV. CENTRE SYDNEY	CONS. COUNCIL SA	THE WILDERNESS SOC. VIC.	AUS. HERITAGE COM.	AUST. CONS. FOUND.	ENV. CENTRE NT. INC.	THE WILDERNESS SOC. NSW.	DEPT T&W ROADS. NT.
	ASSPA	CCNT	DEPT. HEALTH & C. SERVICES	NT MUSEUM	DME - MINES	DID	J.L. SMITH - (JABIRU)	P. BLACKWELL - (TASMANIA)	TIM DEVLIN - (VICTORIA)	GEOFFREY CROKE - (VICTORIA)	TOTAL						
Cumulative Impact of proposal not addressed.				*		*		*	*	*	*	*		*	*	*	
Human health issues not detailed (particularly mosquitoes).															*		
Construction crew accommodation area and location needs not addressed.															*		
Location of Marrakai sub-station.																*	
Lack of attention to areas outside Kakadu (McKinlay area).															*		
Environmental safeguards and standards inadequate.	*	*										*	*	*			
Set back distances of line inadequate.		*														*	
Failure to use mapping tools for sites of significance.									*						*	*	
Rehabilitation: more detail required.															*		
Use of public funds queried.																*	
No comment.			*					*								*	*
SUPPORTED			*				*									*	
NOT SUPPORTED		*		*	*	*	*		*	*	*	*	*	*	*	*	
SUPPORT NOT INDICATED	*														*	*	*
TOTAL	9	22	1	7	5	7	6	1	9	15	13	13	10	10	15	12	5
	14	9	4	1	1	1	15	8	3	1							

TABLE 2
SUMMARY OF IMPACTS, SAFEGUARDS AND FINAL EFFECTS
MARRAKAI-JABIRU 132KV TRANSMISSION LINE

PEO - Project Environmental
Officer

NOTE: Bold typed safeguards indicate those not explicitly stated by the proponent but considered necessary upon review of impacts by respondents to the draft EIS and advisory body review of final EIS.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
A. BIOPHYSICAL		
(1) Major removal of vegetation over length of route and associated work areas and access.	<p>(a) Clearing of easement kept to the minimum necessary for construction. Clearing of 22m of the 34m wide easement only necessary in most areas.</p> <p>(b) Vegetation on either side of creek and river crossings hand cleared from 50m back from flood channel bank.</p> <p>(c) Removal of large trees from accommodation and work areas avoided as much as possible.</p> <p>(d) Clearing or damaging of vegetation and trees not undertaken without written authority of PEO.</p> <p>(e) Regeneration of lower growing plant species permitted and encouraged along length of easement.</p> <p>(f) Clearing of the survey line by dozer will be carried out with the blade held above ground level to preserve root stock and minimise disturbance to topsoil.</p> <p>(g) Previously cleared vegetation shall be returned to the area as a combination of mulch, litter, brush and trunks. This will contain some seed in addition to that contained in the topsoil and will further assist in trapping windblown seed as a regenerative stock. Any native seed which has been opportunistically harvested will be sown at suitable locations particularly within parks and reserves.</p> <p>(h) Active revegetation of highly erodible areas and those which do not naturally revegetate will be undertaken using a combination of native tree seed and approved introduced pasture grass species at the rate of 20kg/ha.</p> <p>(i) Within Kakadu and MRSB native species will be used in preference to pasture grasses. Species used and application of fertilizers will be cleared with ANPWS and CCNT as appropriate before works begin.</p>	Tall growing plant species will be permanently controlled along the easement, altering the natural vegetation communities and the macro and micro-climate environments of remaining plants.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>(j) The success of natural vegetation and rehabilitation procedures will be assessed after the first wet season by the PEO or equivalent environmental personnel. If regrowth is poor introduced seeding and fertilizer will be undertaken prior to the onset of the next wet season and subject to 1(i).</p>	
2. Soil disturbance/compaction from earthworks.	<p>(a) Topsoil disturbance by bulldozer minimised by:</p> <ul style="list-style-type: none"> - safeguards as for 1(f) - using a stick rake for clearing of vegetation - using a stick rake for windrowing of cleared vegetation when necessary in the opinion of the PEO. <p>(b) Stripped topsoil from roads and excavations to be stockpiled for later rehabilitation according to the following:</p> <ul style="list-style-type: none"> - depth of stripping site specific but in general 100-150mm; - stockpile areas not to be stripped of topsoil; - stockpiles not located within drainage lines or around trees; - stockpiles not to exceed a slope of 3h:1V or 5m high; - with linear earthworks such as for new access, topsoil shall be removed and stockpiled on a progressive basis, minimising the time between the soil being stockpiled and being respread for rehabilitation; - where topsoil is stockpiled the most recent stockpiles will be used for rehabilitation. <p>(c) Compacted soil on access roads, construction zones, foundation works, borrow pits and construction camps will be deep ripped, respread with topsoil and appropriate erosion prevention works (Section 3) undertaken.</p>	Some minor effects from soil disturbance can be expected for the life of the transmission line compared with uncleared forest areas.
3. Soil erosion	<p>(a) Erosion reduced by appropriate topsoil management, clearing and revegetation practices outlined in Sections 1 and 2.</p> <p>(b) Construction of erosion control structures where considered necessary by the PEO, land manager or PAWA to the following criteria:</p>	Some minor soil erosion problems can be expected for the life of the transmission line compared with uncleared forest areas.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS										
	<ul style="list-style-type: none">- erosion control banks shall be constructed on all slopes exceeding 10% and on other slopes where an erosion hazard exists;- erosion banks will extend into undisturbed areas to dissipate the energy of runoff;- control banks will be formed to shed water in a manner which will not cause further erosion;- control banks will be constructed at a grade of not more than 2%;- the height of control banks will be sufficient to retain a maximum depth of 150mm and a minimum depth of 100mm;- where more than one bank is required, the down slope end of each consecutive bank shall be staggered to minimise the incrementing of flows and shall have a maximum spacing of:<table><tr><td><u>Slope</u></td><td><u>Bank Spacing</u></td></tr><tr><td>Up to 4%</td><td>As directed by PEO</td></tr><tr><td>4 - 9%</td><td>100m</td></tr><tr><td>10 - 15%</td><td>30m</td></tr><tr><td>>15%</td><td>15m</td></tr></table> <p>(c) Where construction of the transmission line causes erosion on adjacent land, erosion control measures will be the responsibility of the owner/operator.</p> <p>(d) The owner/operator will be responsible for the replacement of any material lost from the easement because of a delay in construction of erosion control banks after backfilling is completed.</p> <p>(e) Where major drainage lines are intersected, any bank disturbance will be protected with gabions until deeper rooted vegetation provides stabilisation.</p> <p>(f) Areas which constitute a more significant erosion risk will be revegetated according to 1(h), (i) and (j).</p> <p>(g) Access over creeks will be by trafficable ramps:</p> <ul style="list-style-type: none">- formed at grades less than 4H:1V with the base of the ramp in line with the toe of the creek bank;- sides of ramps battered to 2H:1V;- armouring of channel bed where necessary and compacted gravel, steel mesh, rock paving or corduroy with logs installed as required;	<u>Slope</u>	<u>Bank Spacing</u>	Up to 4%	As directed by PEO	4 - 9%	100m	10 - 15%	30m	>15%	15m	
<u>Slope</u>	<u>Bank Spacing</u>											
Up to 4%	As directed by PEO											
4 - 9%	100m											
10 - 15%	30m											
>15%	15m											

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<ul style="list-style-type: none"> - a bund will be constructed at the top of the ramp to prevent runoff scouring the track. <p>(h) All tracks will be provided with adequate drainage to prevent erosion.</p> <p>(i) Access to the transmission line easement and associated camps and work areas will be restricted to constructed tracks and to the workforce or authorised personnel.</p> <p>(j) Temporary borrow pits will be rehabilitated using methods based on CCNT Land Conservation Unit Guidelines (Applegate 1983) and the following:</p> <ul style="list-style-type: none"> - side slopes and floor will be shaped to achieve a free-draining site where possible; - the sides and floor of each pit will be ripped along the contours; - walls will be battered to 3H:1V; - control banks will be constructed to reduce erosion risk at specific sites where problems are expected to arise; - stockpiled topsoil will be respread over the disturbed area with subsequent respraying of previously cleared vegetation; - borrow pit access tracks will be restored according to 2(c). <p>(k) Identification of erosion problem areas will be undertaken for the lifetime of the transmission line by PAWA in consultation with the appropriate authority (i.e. CCNT, ANPWS). Where a problem becomes evident the owner/operator will be responsible for all costs attributable to repair and work needed to avoid a recurrence of the problem. In the event the owner/operator fails to undertake the work within a reasonable time following notification of the problem, PAWA may cause the work to be done on behalf of the owner/operator and debit all associated costs to the owner/operator.</p>	
4. Invasion of weeds and plant diseases.	<p>(a) All areas where earthworks are proposed will undergo a preliminary survey by the PEO or a suitably experienced person, preferably in consultation/collaboration with DPIF Weeds Section to identify weeds and related problems which might occur. Incidence of weeds will be mapped on a suitably scaled map. Successive surveys will also be mapped to show changes in the distribution of weed species.</p>	Control of weeds such as Hyptis along the easement is not expected to be entirely achievable as evidenced by the wide occurrence of this species in disturbed areas.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>(b) The contractor must submit to the PEO for approval, details of proposed control measures to prevent spread of noxious weeds from infested areas. The PEO will discuss the details of proposed control measures with DPIF Weeds Section, to ensure that they are appropriate.</p> <p>(c) The contractor will nominate appropriate staff to supervise and carry out the control measures and maintain adequate records of weed control activities. These records will be available on request for inspection by the PEO, DPIF Weeds Section, or appropriate land managers including CCNT and ANPWS.</p> <p>(d) The contractor will schedule work to commence within Kakadu progressing towards weed infested areas to reduce the risk of weed spread into Kakadu.</p> <p>(e) All construction vehicles and machinery operating in Mimosa infested areas will be sterilised by thorough washing down and treatment with an approved herbicide before leaving the infested area and moving to a new area. Access through infested areas will be totally avoided other than in exceptional circumstances. The PEO will inspect cleaned machinery and may refuse to allow it to be unloaded and used if he considers cleaning to be inadequate. Any costs of recleaning will be borne by the contractor.</p> <p>(f) ANPWS requires all vehicles and machinery to be used in Kakadu to be washed down, inspected and approved at either the Park headquarters compound or South Alligator River Ranger Station before proceeding with operations.</p> <p>(g) Soil will not be removed from a site known to be infested with a noxious weed.</p> <p>(h) Prospective borrow pits or sand extraction areas will be avoided if weed infestation is apparent.</p> <p>(i) Professional advice will be sought from Weeds Section of DPIF prior to construction commencing on the Adelaide River Crossing.</p> <p>(j) After rehabilitation the transmission line route will be inspected at least at the beginning and towards the end of each wet season by appropriately experienced personnel to determine whether any weed infestations have occurred. Any such outbreaks will be treated immediately with selective application of approved herbicides. Within Kakadu herbicide use will be subject to approval by ANPWS.</p>	

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
5. Invasion of exotic and pest insects and other pests.	(a) Safeguards 4(e) and 4(f) will reduce the introduction of some exotic and pest insects and other small pests, however no specific safeguards are detailed.	There will be some inevitable introduction of pest and exotic fauna which will be difficult to control.
6. Changes to hydrology.	<p>(a) Stream flow will not be impeded by fallen timber, earthfill or other structures that will generate turbulence or heighten risk of bank erosion.</p> <p>(b) Clearing of vegetation as for 1(b).</p> <p>(c) Soil erosion control as for Section 3.</p> <p>(d) The outlet of spoon drains will be located in well vegetated, undisturbed ground, lower in elevation than the point where the spoon drain intercepts the table drain. Table and spoon drains shall be designed on a site specific basis in relation, to slope, catchment and hydrological criteria, so that they are capable of handling expected flows at non-erosive velocities. Generally the drains will have broad bases (approximately 1 metre) with low grade batters (at least 1V:3H and grades in the channel of the spoon drain less than 1%).</p> <p>(e) Cross drainage will be facilitated by installation of culverts or by the construction of a stabilised armoured invert or floodway where necessary. These will vary in size depending on the catchment above the road and the volume of expected flows.</p> <p>(f) A culvert can be a pipe placed under the road at a point where it intercepts flow in the upslope table drain and channels it under the road. The inlet and outlet of the pipe must be protected and armoured (normally with rocks and/or concrete) to prevent the pipe from being washed out.</p> <p>(g) Culverts will be installed to ensure that there are no vertical drops between the base of the culvert and the stream bed. Fisheries Division of DPIF will be consulted regarding appropriate construction of culverts to avoid impediments to fish migrations.</p> <p>(h) Culverts will be constructed in such a way that water is not artificially ponded, creating mosquito breeding habitat.</p>	<p>Temporary effects on water quality are to be expected prior to the implementation of soil erosion safeguards and revegetation of cleared areas.</p> <p>Some minor increases in runoff may be experienced in some areas for the life of the transmission line.</p>
7. Faunal habitat destruction.	<p>(a) Vegetation clearing and revegetation practices as for Section 1.</p> <p>(b) Soil erosion protection/mitigation as for Sections 2 and 3.</p>	Within easement the faunal habitat of some species will not return to pre-construction conditions for the operational life of the transmission line.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
8. Disturbance to fauna from noise and vibration.	(a) Construction operations at each site will be of relatively short duration (1-2 days) and will be staged to reduce noise impacts.	Noise disturbance will temporarily affect some species.
9. Corridor effects on fauna distribution and migration.	<p>(a) Clearing techniques along the easement will use scalloped rather than linear edges to reduce the linearity of the clearing.</p> <p>(b) Frequent gaps will be left in cleared vegetation windrowed to one side of the easement to allow movement of fauna.</p> <p>(c) Regeneration as for 1(e) to restore habitat for some species and therefore reduce corridor effect.</p>	<p>Corridor effects on some species will remain for the operational lifetime of the transmission line.</p> <p>Cumulative effects of corridors of transmission line and roads, where these are close together, may affect some species.</p>
10. Bird and bat mortality from collision with conductors or earthwires.	<p>(a) The preferred route of the transmission line is away from any significant magpie goose feeding or breeding habitat, reducing the incidence of transmission line effects on this species.</p> <p>(b) The diameters of the conductors and earthwires are larger (20mm and 10mm respectively) than those where bird strikes have been experienced previously, making them more visible and more easily avoided.</p> <p>(c) The field effect surrounding conductors is such as to give birds warning of the proximity of the obstruction.</p> <p>(d) Conductors are widely enough spaced to prevent bridging by birds or bats and death by electrocution.</p>	<p>Migratory or seasonal movements of magpie geese or other bird species may cross the transmission line with potential for transmission line collision and mortality.</p> <p>Field effects of transmission wires do not appear to have affected bird strike in overseas studies (e.g. Faanes, 1987) indicating that strikes may not be reduced by field effects.</p>
11. Impacts on biophysical aspects of World Heritage and National Park Values.	(a) All safeguards in Sections 1-10 will contribute to the reduction of impacts on World Heritage and National Park values.	Some impacts such as the continuing corridor effect will permanently effect biophysical aspects of these values.
12. Fires	<p>(a) The contractor will comply fully with the requirements laid down by the <u>Bushfires Act</u> and Amendments and take all necessary precautions to minimise the chance of igniting a fire of any kind during blasting or construction activity.</p> <p>The following steps will be taken to prevent bushfires during construction:</p> <ul style="list-style-type: none"> - Instruction of all personnel on the importance of fire prevention; 	Some minor effects from fires are to be expected, however, these are unlikely to be significant in the context of current fire regimes experienced in the NT.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<ul style="list-style-type: none"> - clearing to bare earth and use of spark guards where welding and grinding occur; - construction of a 4 metre wide fire break around accommodation units, site offices and storage areas. The fire break may be constructed by rolling or slashing with large trees being felled by hand. This area shall be maintained free of inflammable material. In cases where it is necessary to burn windrowed material, the windrow shall be located on the up-wind side of a clearing with sufficient space around to prevent sparks jumping over to nearby timbered area. During the burning, a fire tender with water, and vehicles with fire fighting equipment shall be on stand-by; - the contractor shall liaise with local authorities and the Bushfires Council for advice on severe fire hazard days; - If requested by the local authority, assistance and machinery will be made available to fight a fire in the area of operations. <p>(b) Fire fighting equipment and training in use of such equipment will be in accordance with conditions of the contract.</p> <p>(c) Where it is necessary to use arc or flame cutting, flame heating, arc or gas welding, the contractor will comply with a current addition of the SAA Cutting and Welding Safety code and will ensure that his sub-contractors also comply.</p> <p>(d) Potential clearing of vegetation to prevent the spread of bushfires in an emergency will be cleared with ANPWS prior to any clearing or construction activities take place, with regard to Kakadu, or other land holders/managers as appropriate.</p>	
13. Impacts of Increased access via construction and maintenance tracks by tourists.	<p>(a) Access along the easement will be located to follow along or nearby the route centre line, however, where there is excessive side slope that would require cut for compensation the PEO in consultation with the Contractor's Site Engineer and where appropriate, property owner or manager, may locate the access away from the centre line to reduce the need for cut and minimise erosion hazards. Similar access relocations may be appropriate in those instances where it will help to negate or avoid environmental constraints.</p> <p>(b) Access to the easement will preferably be via existing tracks and roads. In instances where an existing access parallels an easement, connecting links will be permitted at a frequency and location</p>	Some minor impacts expected from increased access to some areas, including increased soil erosion, waste disposal, hunting.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>to be determined by the PEO. Access on private roads or through private property will be arranged by the Contractor to the satisfaction of the PEO and the relevant landholder.</p> <p>(c) Where existing access provisions do not exist, new access will be formed only with approval from the relevant landholder and the appropriate statutory authorities.</p> <p>Any such access will:</p> <ul style="list-style-type: none"> - Follow existing clearings, firebreaks, fence lines, natural boundaries, etc., to the maximum extent feasible. - In instances where existing fence line is encountered and it becomes necessary to cut that fence, the remaining sections will be properly stayed before this operation. The Contractor shall install and maintain, or shall cause to be installed and maintained temporary fences and temporary gates where required across the break, adequate for efficient stock movement control. - Access tracks not required after construction will be properly rehabilitated as for Sections 1(h),(i),(j), 2 and 3. 	
<p>B. <u>SOCIO-ECONOMIC</u></p> <p>14. Construction workforce accommodation camp impacts on visitors to Kakadu.</p>	<p>(a) Construction camps will be totally self-contained so that there will be no increased demand on camp facilities.</p> <p>(b) The workforce is relatively small, minimising the negative impact of Construction groups moving into relatively small established communities.</p>	Not predictable.
<p>15. Visual/aesthetic impacts.</p>	<p>(a) Reduction of visual impact by the following design concessions.</p> <ul style="list-style-type: none"> - Using poles, a low profile section of line has been designed between Jim Jim Creek and Jabiru. This general area is that overlooked from various vantage points on the escarpment. It is also the area overflown by most scenic flights. - To avoid the need for construction of a second line to provide power to Coolinda, provision has been made for a second circuit to be attached to the main line. 	Some visual impacts will remain for the life of the transmission line. In particular, impacts at road and river crossings and from air tours of Kakadu will be permanent.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<ul style="list-style-type: none"> - Advantage has been taken of guyed pole construction to minimise the visual impact of mass on road travellers through other areas of the park, particularly the relatively open terrain along sections of the Jim Jim road. - Pole spacings have been carefully designed to avoid the need for poles in buffer areas adjacent to roads. - Non-specular conductor has been specified for those sections of the route within Kakadu and McKinlay River Parks. <p>(b) Reduction of visual impact by the following route alignment.</p> <ul style="list-style-type: none"> - Care has been taken to locate the line so that tourist road and track crossings are suitably angled to enable support structures to be located well back from the road. - The location of road crossings has been carefully selected to take advantage of individual situations for minimising visual impacts. For instance the Jim Jim Falls and Nourlangie Rock roads are both sufficiently narrow for the crossing to be located where the vegetation virtually interlocks overhead. As the roads will be crossed about mid span, there will be a tendency for the view of nearby conductors to be lost in the tree canopies. The Arnhem Highway is crossed in Jabiru where a confusion of powerlines and traffic control structures already exist. - Poles will be carefully located in the vicinity of a site about 5.5 kilometres south of Jabiru. Here the line approaches to within approximately 200 metres of the highway at a location where vegetation is sparse woodland with high visibility. - Care has been taken to locate the route to follow along the foot of lower slopes and valleys wherever possible. Steep slopes and situation where there is a need to cross hills at right angles have been avoided because of aesthetic detriment. <p>(c) Clearing of the spans that cross roads will be undertaken by hand. Clearing activity will be otherwise minimised, which means sufficient area to string the conductors without fouling them in vegetation and a safe operating clearance. This means a minimum of 10 metre wide break in the upper storey canopy. Where canopy heights are below 8 metres (a feature of the Jim Jim option) clearing activity will be minimised.</p>	

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>(d) Visual impacts will be further reduced by the construction practice safeguards listed in Sections 1, 2, 3, 4, 6 and 12.</p> <p>(e) Route alignment and location of towers or poles, particularly in visually sensitive areas such as road or river crossings, will be accurately marked on air photos for use by the contractor, in addition to map co-ordinates.</p> <p>(f) The PEO will be on-site at all times during surveying and easement clearing through Kakadu, and in sensitive areas outside Kakadu, to ensure that the positioning of towers/poles and placement of line maximises the reduction of visual impacts, particularly for road and river crossings.</p>	
16. Wastes from camps and construction.	<p>(a) Solid waste materials will be collected in properly designed and constructed containers and transported away from the site to be disposed of in a manner and location approved by the PEO.</p> <p>Refuse will not be dropped free but hoppers and shutters, chutes or refuse buckets will be used. All hoppers, chutes or buckets for refuse will be covered or be of such a design as to fully confine the material and prevent dissemination of dust.</p> <p>(b) Chemical Wastes: subject to statutory and local requirements, liquid contaminants will be contained in approved vessels for disposal at approved sites. Oil spills and other noxious liquid wastes will be managed by appropriate bunding and drainage traps so that they are properly contained. Before vacating the site, contaminated soil will be removed and disposed of at a location and in a manner satisfactory to the PEO or land manager.</p> <p>(c) Putrescible waste will be dropped into hoppers, chutes or buckets which are either fully covered or adequately confine the material. Where possible the wastes will be dumped into recognised waste disposal sites, otherwise they will be dumped in a pit or trench which is located at least 100 metres from a drainage line and above flood level, where they will be compacted and covered with 150 millimetres of subsoil on a daily basis to prevent scavenging. After closure, pits will be covered with one metre of subsoil and re-spread with conserved topsoil. Revegetation as for 1(g),(h), (i),(j).</p>	No impacts expected.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
17. Impacts on Aboriginal Interests.	<p>(a) Known Aboriginal sites of significance at risk of being damaged by construction activity will be located on plan in conjunction with centre line survey activities. Before construction work begins, these sites will be protected by fencing with star pickets at approximately 5 metre centres joined with three strands of 10 gauge galvanised fencing wire. Corner pickets will be stayed and the barrier clearly identified using flutter tape.</p> <p>(b) All sites identified will be avoided, where possible, by careful design and tower spacing. In the unlikely event that there is no alternative, but to cross a site, discussions will be held between the PEO, Aboriginal Sacred Sites Authority, and the relevant custodians to determine the appropriate action and resolution of any problems.</p> <p>(c) The workforce will be instructed about the significance of sites to Aboriginals by the Contractor and any areas identified by custodians will be out-of-bounds to that workforce.</p> <p>(d) Liaison will be maintained between the PEO and the traditional owners to minimise the risk of inadvertently interfering with an unidentified site. The PEO will also supervise operations around sensitive and significant areas to ensure that there is minimum damage or disturbance to such sites.</p> <p>(e) Custodians will accompany construction teams during survey and clearing of the proposed alignment through Kakadu as a final precaution against inadvertent damage of sites.</p> <p>(f) Through Kakadu the final alignment of the route will be subject to approval by traditional owners in order to safeguard Aboriginal Interests other than sacred sites.</p>	<p>Minimal impacts to sacred sites.</p> <p>Impacts on other Aboriginal Interests unpredictable.</p>
18. Impacts on non-Aboriginal sites of significance.	<p>(a) Historic relics and archaeological material are the property of the Northern Territory Government, and any such objects discovered during the course of the project shall be reported to the PEO. The PEO will notify the appropriate authority or the CCNT if in doubt.</p> <p>(b) The Contractor will take action, on the advice of the PEO, to properly protect any relics or archaeological materials pending instructions from the appropriate authority.</p>	<p>Visual impacts will remain. Other impacts expected to be minimal.</p>

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>(c) Sites of significant flora and fauna will be protected by the following:</p> <ul style="list-style-type: none"> - The Contractor will take necessary measures to protect fauna from hunting and other avoidable interference. Carrying or the use of firearms is prohibited. - Pits or holes dug for foundations or other construction purposes will not be left in an unsafe condition. Covers or fences will be used to guard against stock or native fauna wandering into them. - Access through creeks will be located prior to survey so that unnecessary clearing and earthworks are avoided. To achieve this the PEO shall work in front of the survey team to help identify appropriate points of access. - Access shall not be constructed to cross the following creeks and rivers; <ul style="list-style-type: none"> • Mary River • South Alligator River • Barramundie Creek • Jim Jim Creek • Nourlangie Creek - The need to construct the line through monsoon forest areas will be avoided if at all possible, since clearing through these forests alters their light, moisture and fire regimes, opening them to weed invasion and leading to degradation of the system. In those instances where it is not possible to avoid such areas the PEO will consult appropriate officers of the CCNT and/or other relevant organisations to advise of the possibility of damage prior to work commencing. <p>(d) In areas where visual impacts on sites of significance are considered to be high, e.g. at the Jim Jim backpackers hostel, towers or poles will be camouflage painted or visually screened by other means such as planting of trees and shrubs.</p>	
19. Impacts on pastoral land use including damage to stock, fences, accelerated deterioration of tracks and risks of fire.	<p>(a) All temporary fences shall be removed and permanent fences restored to the satisfaction of the landholder.</p> <p>(b) Private roads used by the Contractor for access will be properly maintained to a standard at least equal to that when the road is first used.</p>	Impacts minimal, some expected to be beneficial e.g. more gates, fire break maintenance.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>(c) The Contractor will liaise with landholders during construction to agree to the most mutually acceptable scheduling of construction with normal activities, such as mustering and with constraints in certain areas attributable to wet season conditions.</p> <p>Maintenance crews will notify pastoralists and other landowners/managers of an intended visit and will leave gates as found; take due care with fires as for Section 12, remove all rubbish and avoid interfering with stock or musters.</p> <p>(d) If necessary, aerial marking of the transmission lines will be undertaken by the owner/operator where the lines present a significant hazard to mustering aircraft.</p> <p>(e) Gates installed in pastoral property fences will be retained if the owner/manager approves and will be managed as advised by owner/manager.</p> <p>(f) The owner/operator will enter into a formal agreement with each landholder to record any special provisions or safeguards required. Each recording will be entered onto a construction list so that special provisions may be observed during each stage of the project. Issues which may affect landholders include:</p> <ul style="list-style-type: none"> - disruption of routine activities during construction; - noise; - dust; - possible damage to improvements and stock; - exposure to the risk of disease spreading; - interface of towers with agricultural activities; - aesthetics; - continued access for maintenance; - conditions of entry onto private land. 	
20. Impacts on the proposed Mt Bunday military field firing range.	(a) The alignment skirts the designated firing range to the due north.	No impacts predicted.
21. Contractual breaches/ ineffective contractual administration.	(a) The transmission line will establish authority to implement safeguards, including provision for the appointment of a PEO. The PEO will be a suitably qualified environmental officer or scientist approved by PAMA and CCNT who will be responsible for contractual adherence to all safeguards and advise on mitigative and ameliorative measures as detailed in the above sections.	Ensuring that contractual arrangements are enforced and penalties for breaches are appropriate may be difficult and result in impacts overall being greater than expected.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
	<p>(b) Standards and procedures will be clearly and unambiguously stated in the contractual document, and penalties for non-compliance will be adequate and enforceable. A twelve month guarantee of work quality will be supported by appropriate financial bonds.</p> <p>(c) Effective communication and liaison will be maintained with all of the following Interested/Involved parties:</p> <p>PAWA</p> <ul style="list-style-type: none"> - Project Environmental Officer <p>CONSTRUCTOR</p> <ul style="list-style-type: none"> - Project Manager <p>PERSONS AND ORGANISATIONS AFFECTED</p> <ul style="list-style-type: none"> - Conservation Commission of the N.T. - Australian National Parks and Wildlife Service - Land Owners/Lesseees - Northern Land Council - Aboriginal Sacred Sites Protection Authority - Mining Companies. <p>AUDITING AUTHORITIES</p> <ul style="list-style-type: none"> - Conservation Commission of the N.T. - Federal Department of the Arts, Sport, the Environment, Tourism and the Territories <p>(d) All employees of the Contractor will be advised by written instruction, reinforced by verbal briefings, of the requirement to protect the environment and the procedures to which they will be required to adhere. Employees will also be advised that failure to observe any requirement with respect to protection of the environment may result in dismissal.</p>	
22. Increased dust.	<p>(a) Where required by the PEO, dust control measures will be employed to minimise hazard, inconvenience or damage to the public, private property, the environment, construction personnel and construction processes. Control measures may include gravelling, watering, and imposition of speed limits. Dust suppression would normally be applied where dust would:</p> <ul style="list-style-type: none"> - impact on dwellings or other non-transient human activity; - represent safety hazards; - impact on construction campsites; - cause problems for all construction activities. 	Minimal impact expected.

POTENTIAL IMPACTS	SAFEGUARDS	PREDICTED EFFECTS AFTER SAFEGUARDS
23. Increased incidence of mosquitoes through creation of breeding habitat.	<p>(a) Care will be taken to avoid creation of mosquito breeding habitats, in particular areas where water ponds due to construction earthworks altering hydrology.</p> <p>(b) The PEO will consult with the Medical Entomology Branch of the NT Dept of Health and Community Services regarding construction practices to prevent the creation of mosquito breeding habitat and advise the Contractor of requirements on this matter.</p>	Minimal impacts expected.

APPENDIX I

Public Examination Places, Marrakai-Jabiru
132kV transmission line Draft EIS

Secretary

The Department of the Arts,
Sports the Environment Tourism
and Territories
Environmental Assessment Branch
GPO BOX 787
CANBERRA ACT 2601
Attention: D Bradley
Dear Derek

Director

Conservation Commission Northern Territory
PO BOX 496
PALMERSTON NT 5787
Attention: Mr P Wright
Dear Peter

Customer Advisory Centre PAWA
Ground Floor, Jape Building
18-20 Cavenagh Street
DARWIN NT 5794

Australian Conservation Foundation
672B Glenferrie Road
HAWTHORN VIC 3122
Attention: Mr P Toyne
Dear Mr Toyne

The Environment Centre of NSW
176 Cumberland Street
SYDNEY NSW 2000
Attention: Pam Eiser

Environment Centre (Victoria)
247 Flinders Street
MELBOURNE VIC 3000
Attention: Chris Day

Queensland Environment Centre
Brisbane School of Arts Building
166 Ann Street
BRISBANE 4000
Attention: Liz Bourne

Conservation Centre of SA
120 Wakefield Street
ADELAIDE SA 5000
Attention: Marcus Bereford

Environment Centre of WA
1st Floor
794 Hay Street
PERTH WA 6000
Attention: Geoff Sims

Tasmanian Environment Centre
102 Bathurst Street
HOBART TAS 7000
Attention: Peter Blackwell

The Environment Centre
GPO BOX 2120
DARWIN NT 5794
Attention: Mike Krokenberger

Katherine Public Library
Stuart Highway
KATHERINE NT

NT Reference Library
Cavenagh Street
DARWIN NT 5794

Darwin Public Libraries
Nightcliff/Casuarina
Centrepont Building
DARWIN NT 5794

The Information Centre
Kakadu National Park
PO BOX 71
JABIRU NT 5793
Attention: Mr B Gall

Darwin Library
GPO BOX 84
DARWIN NT 5794

Nightcliff Library
Pavonia Place
NIGHTCLIFF NT 5792

Casuarina Library
Bradshaw Terrace
CASUARINA NT 5792

Reference Library
GPO BOX 42
DARWIN NT 5794

Jabiru Library
Government Offices
JABIRU NT 5796

Katherine Library
PO BOX 1571
KATHERINE NT 5780

The State Librarian
State Reference Library
40 James Street
PERTH WA 6000

Reference and Information Centre
State Library of Victoria
328 Swanston Street
MELBOURNE VIC 3000

The Acquisitions Librarian
State Library of N.S.W.
Macquarie Street
SYDNEY NSW 2000

Deputy Reference Librarian
State Library of South Australia
North Terrace
ADELAIDE SA 5000

Mr Dennis Abott
State Library Tasmania
91 Murray Street
HOBART TAS 7000

The Serials Librarian
State Library of Queensland
William Street
BRISBANE QLD 4000

-APPENDIX TWO-

LIST OF RESPONDENTS;

1. Peter Blackwell
4 Petty Street
Wesy Hobart
Tas 7000
2. Big Scrub Environment Centre
88A Keen Street
Lismore 2480
3. Conservation Council of the
South East Region and Canberra
G.P.O. Box 1875
Canberra ACT 2601
4. Queensland Conservation Council
Inc Townsville Environmental Centre
477 Flinders Street
Townsville Qld 4810
5. Tasmanian Conservation Trust Inc
102 Bathurst Street
Hobart 7001
6. Aboriginal Sacred Sites Authority
G.P.O. Box 1890
Darwin N.T. 0810
7. Power and Water Authority
G.P.O. Box 1701
Darwin N.T. 0801
8. Department of Transport and Works
Roads Division
P.O. Box 61
Palmerston N.T. 0831
9. Department of Health and
Community Services
G.P.O. Box 1701
Darwin N.T. 0801
10. Department of Industries and
Development
G.P.O. Box 4160
Darwin N.T. 0810
11. Museums and Art Galleries of the NT
G.P.O. Box 4646
Darwin N.T. 0801
12. Department of Mines and Energy
G.P.O. Box 2901
Darwin N.T. 0801
13. The Environment Centre N.T. Inc
G.P.O. Box 2120
Darwin N.T. 0801
14. Geoffrey Croke
160 Hotham Street
East Melbourne VIC 3002
15. Northern Land Council
Highway Arcade
47 Stuart Highway
Darwin N.T. 0800
16. Power and Water Authority
Chief Engineer Hydrology
G.P.O. Box 1096
Darwin N.T. 0801
17. C.C.N.T.
Darwin Office
P.O.Box 496
Palmerston N.T. 0831
18. Tim Devlin
119 Hume Street
Wodonga VIC 3690
19. The Australian Peoples
Representative Council
Rodney VanWegen
45/3 Wood Street
Findon S.A. 5023
20. Australian Heritriage Comm.
G.P.O. Box 1567
Canberra ACT 2601
21. Aust. Conservation Foundation
672B Glenferrie Road
Hawthorn VIC 3122
22. The Wilderness Society
59 Hardware Street
Melbourne VIC 3000
23. The Wilderness Society
57 Liverpool Street
Sydney N.S.W. 2000
24. John L Smith
5 Nash Place
Jabiru N.T. 5796
25. ANPWS
G.P.O. Box 636
Canberra ACT 2601
26. Department of Arts Sport
the Environment Tourism
and Territories
G.P.O. Box 787
Canberra ACT 2601
27. Total Environment Centre Inc
8 Arygle Street
Sydney NSW 2000
28. Conservation Council of S.A.
120 Wakefield Street
Adelaide S.A. 5000