Proposed Katherine to Gove Gas Pipeline

Supplement to the Draft Environmental Impact Statement

September 2013

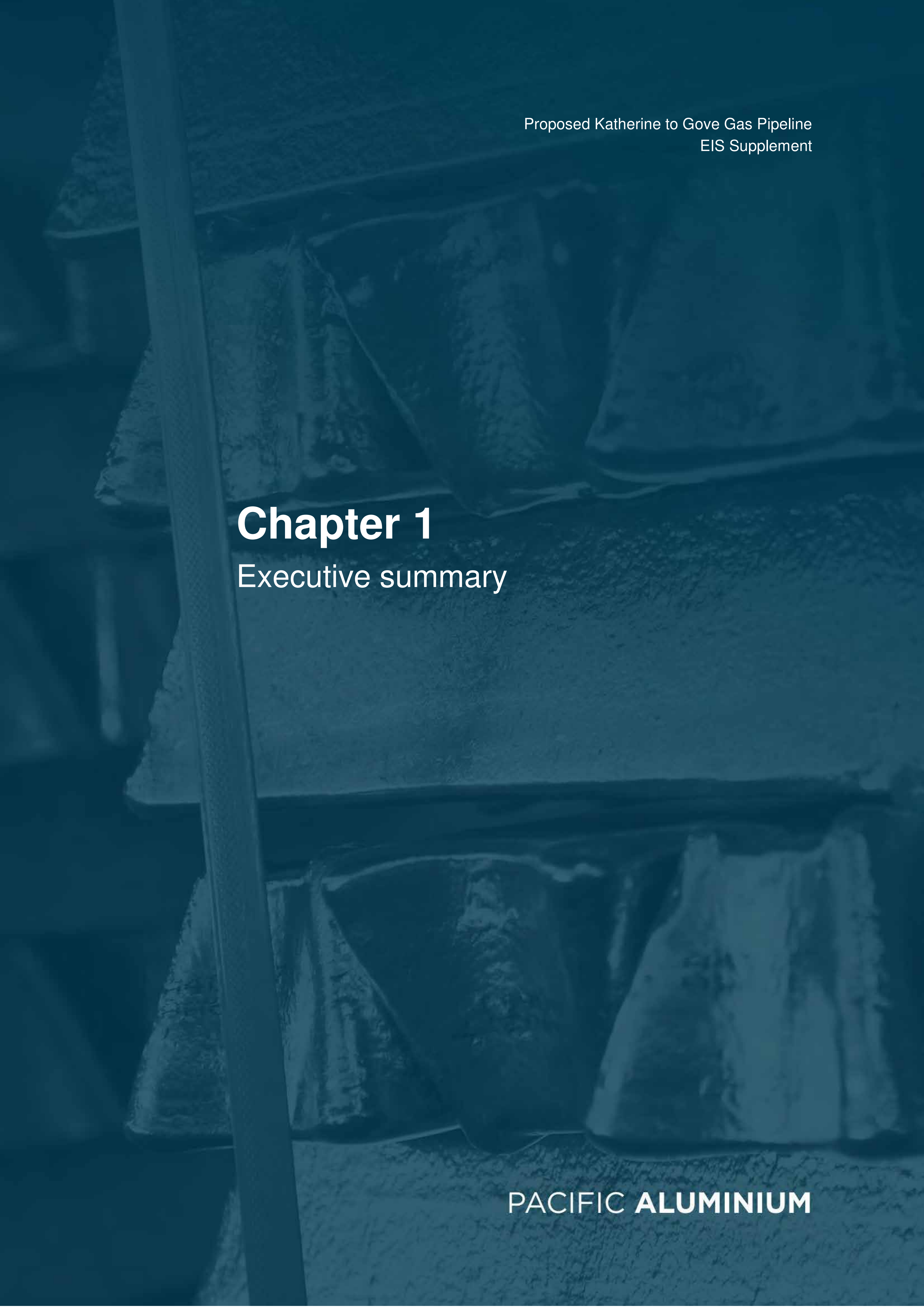
KATHERINE-GOVE GAS PIPELINE

PACIFIC ALUMINIUM

CONTENTS

Note: A glossary and list of acronyms can be found in the Draft EIS


PACIFIC ALUMINIUM



Chapter 1

Executive summary

PACIFIC **ALUMINIUM**

Contents

1 Executive summary

1.1 BACKGROUND TO THE KGGP PROJECT AND THIS DRAFT EIS SUPPLEMENT

Pacific Aluminium is proposing to construct and operate a buried 600 km gas pipeline, from a tie-in with the NT Amadeus Gas Pipeline (just south of Katherine) across Arnhem Land to its refinery in Gove: the Katherine to Gove Gas Pipeline (KGGP) Project (Figure ES-1).

In November 2012, the NT Environment Protection Authority (NT EPA) determined that, under the NT *Environmental Assessment Act* (the EA Act), the Katherine to Gove Gas Pipeline (KGGP) Project required environmental assessment at the level of an Environmental Impact Statement (EIS). The Commonwealth Government subsequently determined that the KGGP Project was a 'controlled action' requiring assessment and approval under the *Environment Protection and Biodiversity Conservation Act* (the EPBC Act) (reference: 2012/6605). The controlling provisions under the EPBC Act are:

- Listed threatened species and communities (sections 18 and 18A).
- Listed migratory species (sections 20 and 20A).

The Commonwealth Government advised Pacific Aluminium on 9 April 2013 that the project will undergo accredited assessment under the NT EA Act. Consequently, the KGGP Project is being assessed under the Northern Territory environmental impact assessment (EIA) process and the outcomes of that assessment will be provided to the Commonwealth Government to inform approval processes under the EPBC Act. Approval will also be considered in accordance with the provisions NT *Energy Pipelines Act*.

Pacific Aluminium prepared a Draft EIS which it released on 4 May 2013 for a period of eight weeks of community and government comment, which generated 11 submissions, all from government departments and non-government organisations (Table ES-1).

Between January and mid-September 2013 Pacific Aluminium conducted over 100 consultations**.** This consultation took various forms and included EIS consultation forums and information stands, briefings, meetings, field work, telephone calls and teleconferences, and attendance at community events. During these consultations Pacific Aluminium met with a wide range of stakeholders including local, Territory and Commonwealth government agencies, Traditional Owners and communities, pastoralists, businesses and business associations, non-government organisations and associations, and the general public. In addition to these consultations, regular weekly or fortnightly meetings were held with the Northern Land Council (NLC).

These consultations informed the stakeholder of the Draft EIS content and project phases, consequences of changed land use, and relevant issues highlighted in the social impact assessment. The engagement conducted is summarised at Appendix E to the Supplement.

The NT and Commonwealth Governments require Pacific Aluminium to respond to all concerns, queries and other issues raised in those submissions, in a published Supplement to the Draft EIS. In addition to providing responses to these issues (Chapter 6 and Appendix A), the Supplement also includes new information not available at the time of publishing the Draft EIS but required for the NT and Commonwealth to complete their EIA processes, including;

- Updated or revised project design (including alignment, construction schedules, size of right of way, and materials; Chapter 3);
- Additional environmental information or additional analyses of flora and fauna data (including results from additional surveys completed in 2013; Chapter 4); and
- Additional analyses of impacts, particularly in relation to Matters of National Environmental Significance (MNES) species of concern (including listed threatened flora and fauna species) and associated with proposed changes to alignment and other project design matters (Chapter 5).

Table ES-1: Respondents to the Draft EIS for the Katherine to Gove Gas Pipeline

RESPONSE NO.	COMMENT RECEIVED FROM
1	Department of Defence (Federal)
2	Amateur Fishermen's Association of the Northern Territory
3	Department of Business (Northern Territory)
4	Department of Health (Northern Territory)
5	Department of Transport (Northern Territory)
6	Environment Centre of the Northern Territory
7	Northern Land Council
8	Department of Primary Industry and Fisheries (Northern Territory)
9	Dhimurru Aboriginal Corporation
10	Department of Land Resource Management (Northern Territory)
11	NT Environment Protection Authority (incorporating comment from Federal Department of Sustainability, Environment, Water, Population and Communities)

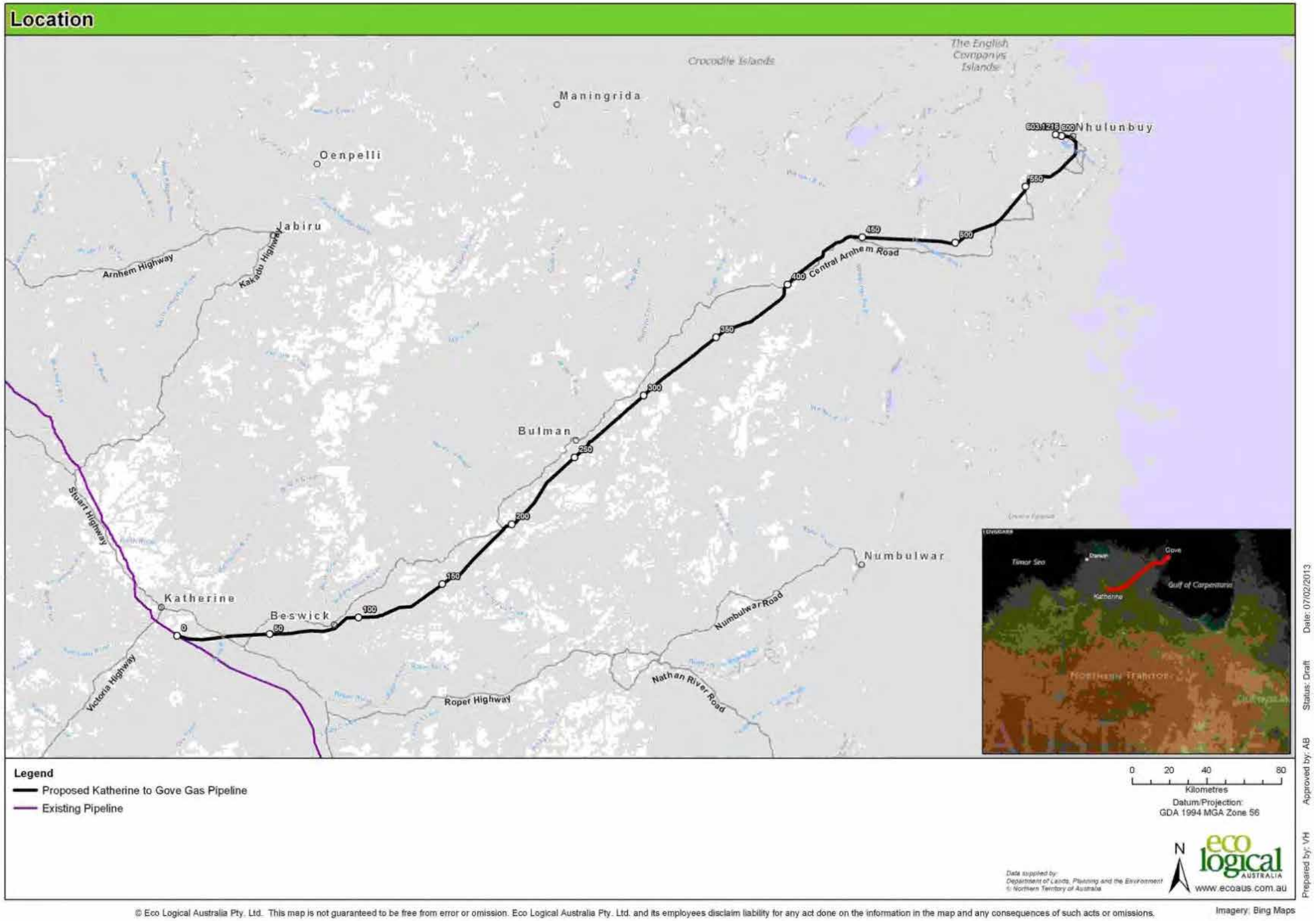


Figure E.S-1: Regional location of the Katherine to Gove Gas Pipeline

1.2 UPDATED PROJECT DESCRIPTION

The Draft EIS described a one-year construction schedule, involving two teams of workers working simultaneously on an eastern and western spread, with the majority of construction during the 2014 dry season (ramping up in March and peaking in July-August). More recent planning and refinement/amendment of design of the KGGP project has, however, required consideration of a two-year build option comprising only one construction team, commencing in February 2014 at the Katherine end of the KGGP and completing as much pipeline installation as possible by the end of November, before the arrival of the wet season. Construction of the remainder of the pipeline would re-commence in February 2015, with pipeline construction completion expected by November 2015, and first gas delivery to the refinery in January 2016. A re-evaluation of the environmental and socio-economic risks of the two-year build option in comparison with a one year build was conducted and is presented in Supplement Chapter 3. The two-year build option does not change the pipeline scope or the timing of the full refinery conversion, which remains early 2016. Impacts from the two-year build option are not substantially different from the one-year option.

During the course of further design work for the KGGP project, a number of possible adjustments to the proposed alignment of the KGGP have been proposed and these are discussed in detail in Chapter 3. The adjustments to the alignments avoid multiple river crossings; minimise the number of properties crossed; move the pipeline further away from culturally sensitive sites; and avoid mining leases or areas where access for construction is not certain; and other reasons. Most of the realignments are minor. Vegetation mapping and additional GIS analysis conducted for threatened species of concern, indicate that the predicted environmental outcomes associated with the realignments are not expected to vary materially from those associated with the original alignment (Chapter 5). The largest proposed realignment responds to Aboriginal traditional owner requests for Pacific Aluminium to consider an alternate alignment through the Mitchell Ranges, a distance of approximately 70 km. A preliminary survey for habitat values along the realignment (section 5.15) indicates that outcomes for Matters of NES would be unlikely to alter should construction of this option be implemented. Additional survey is proposed to inform detailed alignment and management options.

Additional detail and mitigation has been provided in respect of how the ROW will be located within the pipeline corridor to minimise disturbance when passing through areas of higher habitat value. At the time of survey and pegging of the 30 m ROW within the 100 m pipeline corridor, all opportunities to avoid identified habitat trees important for breeding of Gouldian Finch, Red Goshawk and Northern Crested Shrike-tit will be undertaken by fine scale realignment of the ROW within the pipeline corridor. A qualified ecologist would be on-site to assist in identifying habitat trees and the appropriate position of the ROW within the pipeline corridor. Consideration will be given to reducing the working width of the ROW in those areas identified above to minimise the removal of identified habitat trees, where options for realignment of the ROW within the pipeline corridor cannot avoid disturbance. Details are provided in Section 3.4 of this Supplement.

During the design phase, a number of generally small adjustments have been made to the exact locations of some of the above-ground supporting infrastructure for the KGGP, including the compressor station (which would need to alter location with a shift in tie-in to the Amadeus Pipeline) and main line valves. None of these changes is expected to materially alter the environmental outcomes predicted from the original alignment reported in the Draft EIS. Details of these adjustments are provided in Supplement Section 3.5.

The Draft EIS indicated that approximately 265 km of existing access tracks and 110-150 km of new access tracks may be required to assist in the construction of the KGGP. As a result of recent adjustments to project design, the current figures indicate approximately 230 km of existing access tracks and 152 km of new access tracks would be required. Measures to potentially reduce the length of required access tracks (and associated vegetation clearing) are currently under consideration as part of detailed design planning. Section 3.6 of the Supplement provides details.

The Draft EIS estimated that up to 2,200 ha of native vegetation would be removed during construction of the KGGP of which up to 1,365 ha was anticipated to return to native woody vegetation over time through a combination of natural regrowth and active rehabilitation. Following revision of the clearing required, it is now estimated that up to 2,316 ha of native vegetation would be removed during construction of the KGGP of which up to 1,398 ha is anticipated to return to native woody vegetation over time through a combination of natural regrowth and active rehabilitation. Details are provided in Section 3.8.

1.3 ADDITIONAL INFORMATION AND IMPACT ANALYSIS

Coarse scale vegetation mapping was presented in the Draft EIS. To assist in better defining the habitats within the project area, additional finer scale vegetation mapping has been conducted across the length of the pipeline corridor, using a mixture of remote sensing techniques and the findings of the vegetation surveys conducted for the Draft EIS.

The vegetation mapping analysis confirms that no mangroves (*Avicennia*, *Ceriops* or *Rhizophora* closed forests), no rainforests (vine forest, vine thicket) and no sandstone shrubland would be cleared along the ROW as proposed. The analysis also confirms the conclusions presented in the Draft EIS regarding vegetation communities impacted by clearing vegetation for the ROW. *Eucalyptus* woodlands, *Eucalyptus* open forest and *Eucalyptus* open woodland would be the dominant vegetation communities affected by clearing and are widespread in the region. As a result of the low percentage loss of vegetation communities in their regional context, and mitigation measures put forward in the Draft EIS (Appendix O), potential impacts on vegetation are expected to be negligible to low and therefore considered not significant.

The Draft EIS presented detailed flora and fauna survey information across the majority of the KGGP corridor. A small (40 km) section of the pipeline corridor to the north of the Mitchell Ranges was not surveyed as landholder consent had not, at the time, been obtained. The Draft EIS indicated this area would be surveyed and with landholder consent obtained, the survey was conducted in May 2013. The results of this survey and analysis of potential environmental impacts are presented in Chapters 4 and 5 of the Supplement. The results of the survey did not alter the predicted environmental outcomes for fauna or flora, as set out in the Draft EIS.

The Draft EIS indicated that the threatened plant species *Pternandra coerulescens* was known to occur within 750 m of the proposed pipeline centreline. Given the close proximity and potential for dispersal of the plant in the period since earlier surveys were undertaken, additional targeted survey for this species was conducted (section 4.3). The survey did not record the species within the proposed pipeline corridor, the nearest survey record being 56 m from the proposed pipeline centreline.

A significant population of Gouldian Finches was recorded in the vicinity of the pipeline corridor during the terrestrial fauna survey conducted during November 2012 and reported in the Draft EIS. Further survey of the critical resource requirements for this species was conducted in the area between KP0-140. The results of the survey (section 4.5) indicate that establishment of the ROW for the pipeline is estimated to result in the clearing of between 33 and 101 ha of breeding (and coincident dry season foraging) habitat, including potential clearing of approximately 165 Salmon Gum trees. These results have necessitated a re-evaluation of the impact assessment for the Gouldian Finch that was presented in the Draft EIS. Additional mitigation is proposed and summarised in Table E.S-2.

Table E.S-2: Summary of additional proposed mitigation for potential impacts on Gouldian Finches

IMPACT	ADDITIONAL AVOIDANCE / MITIGATION / MANAGEMENT
Loss of potential breeding habitat	Pre-clearing assessment by qualified ecologist. Minimising disturbance of trees with nesting hollows by re-alignment of the centreline. Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared.
Disturbance or loss of nests	Pre-clearing assessment by qualified ecologist. Minimising disturbance of trees with nesting hollows by re-alignment of the centreline. Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared. Timing the removal of Salmon Gums to avoid disturbance of active nests. Creating artificial nesting habitat in nearby areas using hollows from Salmon Gums that cannot be avoided through realignment or reducing the working width of the ROW.
Disturbance or loss of water in drainage lines or disturbance of drinking individuals	Risk assessment and adaptive management process for watercourse crossings incorporating option to delay construction of crossing until dry.
Disturbance or loss of spring complex at KP118	Shifting of ROW to the north of the corridor to increase the distance between construction activities and waterhole.

It is considered that although large areas of breeding (and coincident dry season foraging) habitat occur outside of the pipeline corridor, the residual impact on this habitat is potentially a significant impact on the species because of the known occurrence of a significant population of the Gouldian Finch at Beswick/Chambers River. An environmental offset of 931 ha involving habitat enhancement through better fire management is proposed to mitigate the extent of the residual impact, consistent with the Commonwealth *EPBC Act Environmental Offsets Policy*.

Additional GIS analysis was undertaken of wet season foraging habitat for the Gouldian Finch. The predicted removal of 378 ha of wet season foraging habitat represents 0.08% of the maximum extent of potential wet season foraging habitat within 20km of breeding (and coincident dry season foraging) habitat and is lower than predicted in the Draft EIS (1,500 ha). The additional habitat analysis has confirmed and strengthened the conclusion in the Draft EIS that residual impact on this habitat type would be low and an offset for wet season foraging habitat is therefore not proposed.

Additional GIS analysis for other threatened species of concern (Northern Masked Owl, Northern Crested Shrike –tit, Red Goshawk and Northern Quoll) have provided revised estimates of the potential impact of vegetation clearing on habitat values for these species. The results of these analyses confirm the predictions in the Draft EIS that impacts on these species will be low and offsets are not proposed.

Further development of the strategy for watercourse crossings has been undertaken to provide a clearly defined and robust 'Risk Assessment and Adaptive Management' (RAAM) methodology for the selection of watercourse crossing construction techniques. The RAAM methodology acknowledges the variability of flow conditions in watercourses depending on the wet season conditions preceding construction. Through the RAAM approach, watercourse crossing techniques selected for the KGGP project will balance the overall disturbance footprint with site specific constraints. Depending on site specific assessment the project team will consider options such as deferring construction until a watercourse is dry, as well as the additional use of horizontal direct drilling (HDD) techniques.

Additional detail on measures to reduce the risk of wildlife injury or mortality from falling into the open trench is provided in the form of a fauna handling procedure included as Appendix D to the Supplement.

1.4 RESPONSE TO COMMENTS

Eleven submissions were received on the Draft EIS, comprising seven government agencies and four non-government organisations. The most frequently raised issues in submissions were:

- Further clarification of project description.
- Construction of watercourse crossings.
- Health and safety.
- Management of weeds and feral animals.
- Impacts on Freshwater Sawfish.
- Impacts on Gouldian Finch.
- Other conservation significant flora/fauna species (including those not considered) and management.
- Impacts of noise on fauna and/or local communities.
- Local employment.
- Detail in Management Plans.

The proponent's response to these issues and others is discussed in Chapter 6 and in the detailed comment – response table at Appendix A to the Supplement.

1.5 ADDITIONAL COMMITMENTS

Additional commitments made to further mitigate or monitor impacts from construction and operation of the KGGP Project are summarised in Table E.S-3.

Table E.S-3: Additional commitments made to mitigate environmental impacts

COMPONENT OF PROJECT OR ASPECT OF ENVIRONMENT TO BE MANAGED	COMMITMENT	TIMING	CHAPTER OF EIS SUPPLEMENT
Final alignment of the pipeline corridor	A Final Alignment Plan (or plans in the event of a 2 year build) will be submitted to DSEWPaC and NT EPA advising of the finalised proposed alignment in respect to a number of realignment options detailed in section 3.3 of the EIS Supplement.	Design phase	Chapter 3
Mitchell Ranges alternative alignment – habitat and cultural heritage values	Additional survey will be conducted to inform management options addressing flora, fauna and cultural values, prior to construction. A report will be prepared detailing how habitat values for threatened species and cultural heritage values will be avoided. The report will accompany submission of Final Alignment Plan for that section of the alignment. In event significant habitat values cannot be avoided, an offset would be proposed to mitigate the residual impact. This would be detailed in the above report.	Design phase	Chapter 3
Establishment of the ROW within the pipeline corridor – avoiding and minimising disturbance to habitat values	At time of survey and pegging the ROW, all feasible opportunities to avoid identified habitat trees (Gouldian Finch, Red Goshawk and others) will be undertaken by: • Fine scale positioning of the ROW within the pipeline corridor. • Consideration of reduced working width where positioning of the ROW within the pipeline corridor cannot avoid disturbance • Implementation of above to be advised by a qualified ecologist.	Design phase	Chapter 3
Access tracks and construction camps	Prior to construction of access tracks and construction camps the proposed locations will be subject to: • vegetation/habitat mapping • searches for threatened and/or migratory species listed under Territory or Commonwealth legislation, • heritage survey Within six months of completion of construction, Pacific Aluminium will submit a Final Access Track and Construction Camp Summary Report to the NT Government and DSEWPaC demonstrating how the access tracks/camps were designed and	Design and construction phase	Chapter 3

	constructed to avoid or mitigate impacts to important habitat values and cultural heritage values. The Final Access Track and Construction Camp Summary Report will indicate those access tracks, or parts there-of, that are not required post-construction and detail how these and the construction camp sites have been, or are in process of being, rehabilitated following construction.		
Access tracks and construction camps	The total area of clearing for construction camps and access tracks is not anticipated to exceed 367 ha.	Design and construction phase	Chapter 3
Watercourse crossing at Latram River – threatened plant species	A qualified botanist will be on-site during construction of this HDD crossing at Latram River to ensure that entry and exit pits are sited to avoid the threatened plant species *Pternandra coerulescens*. Written confirmation that this has been achieved will be included in reporting against the project's overarching Environmental Management Plan (EMP). In the unlikely event that HDD cannot be employed and open-trench techniques are required, a qualified botanist will be on-site during construction to confirm avoidance or if removal of currently unrecorded plants is required, the provisions of the TPWC Act will be complied with. Written confirmation that this has been achieved will be included in reporting against the project's overarching Environmental Management Plan (EMP).	Construction	Chapter 5
Gouldian Finch- loss of potential breeding habitat and disturbance/loss of nests	Pre-clearing assessment will be undertaken by qualified ecologist. Disturbance of Salmon Gums with nesting hollows will be minimised through fine scale alignment of the ROW within the pipeline corridor. Where possible the number of trees with nesting hollows required to be cleared will be reduced by reducing the working width of the ROW for short distances. Timing of the removal of Salmon Gums not able to be avoided will be conducted to avoid disturbance of active nests. Artificial nesting habitat will be created in nearby areas using hollows from Salmon Gums that cannot be avoided and are required to be removed.	Construction phase	Chapter 5
Gouldian Finch - disturbance or loss of water in drainage lines or	A risk assessment and adaptive management process for watercourse crossings will be implemented incorporating the option to delay construction of crossing until dry.	Construction phase	Chapter 5

disturbance to individuals drinking	No water extraction for the project will occur from isolated (refuge) pools.		
Gouldian Finch - disturbance or loss of spring complex at KP118	The ROW will be shifted to the north of the corridor to increase the distance between construction activities and the waterhole.	Design phase	Chapter 5
Gouldian Finch – offset to likely residual impact on breeding habitat	Pacific Aluminium proposes an environmental offset of 931 ha to mitigate the extent of the residual impact to an estimated 101 ha of potential breeding (and dry season foraging habitat) for the Gouldian Finch, consistent with the Commonwealth *EPBC Act environmental offsets policy*. The offset will be achieved through a habitat enhancement program using fire management.	Post construction / operations phase	Chapter 5
Watercourse crossings	Selection of crossing methodology will be guided by a Risk Assessment and Adaptive Management (RAAM) Strategy. For those watercourses providing potential habitat for the Freshwater Sawfish, this strategy will be informed by an independent and recognised Freshwater Sawfish expert. The RAAM Strategy incorporates the option of deferring construction of crossing (not already identified for HDD) if the watercourse is in flow.	Design and construction phases	Chapter 6
Hydrotest water - disposal	Water storage ponds will be fenced and an additional barrier will be fixed to the bottom of the fence to discourage use by smaller wildlife In the unlikely event that biocides are required to be used in the hydrotest water, a risk assessment will be undertaken beforehand to ensure that the chemical used has low mammalian and bird toxicity, at the anticipated concentrations. To minimise the potential use of water storage ponds (if required) by Gouldian Finches, the ponds would not be located within identified breeding (and coincident dry season foraging) habitat for the Gouldian Finch or, outside of breeding (and coincident dry season foraging) habitat: within 4 km of identified patches of (> 1 ha) of Salmon Gums.	Construction phase	Chapter 6
Water extraction for project needs	A report outlining the water expectations for the project will be submitted to the NT EPA and NT Department of Land Resources Management prior to commencing construction. No water will be extracted from isolated (refuge) pools.	Design and construction phases	Chapter 6

	Where water is proposed to be extracted from a flowing surface water source that has been identified as providing potential habitat for Freshwater Sawfish, the Water Supply and Adaptive Management Strategy for the project will incorporate a requirement for site specific hydrological assessment, informed by an independent and recognised Freshwater Sawfish expert aimed at identifying extraction rates and stop points for pumping that will result in continued flows enabling continued Freshwater Sawfish passage.		
Weed Management	Grader Grass will be added as a target species More detailed weed mapping will be undertaken which will aggregate the most recent data available from DLRM, the results of reconnaissance weeds survey, and the collection of more detailed weed incidence data to be collected prior to construction. Detailed weed data will be collected and provided to DLRM in accordance with 'Guidelines for weed data collection in the Northern Territory, Version 3.0' (NRETAS 2010). Weed management strategies will be initially focused on the construction phase and five year period post construction (operational phase).	Design and construction phases	Chapter 6
Trenching operations – fauna management	Ongoing monitoring and management of fauna that may enter the open trench will be consistent with the Native Fauna Handling Management Procedures (Appendix D to the EIS Supplement).	Construction phase	Chapter 6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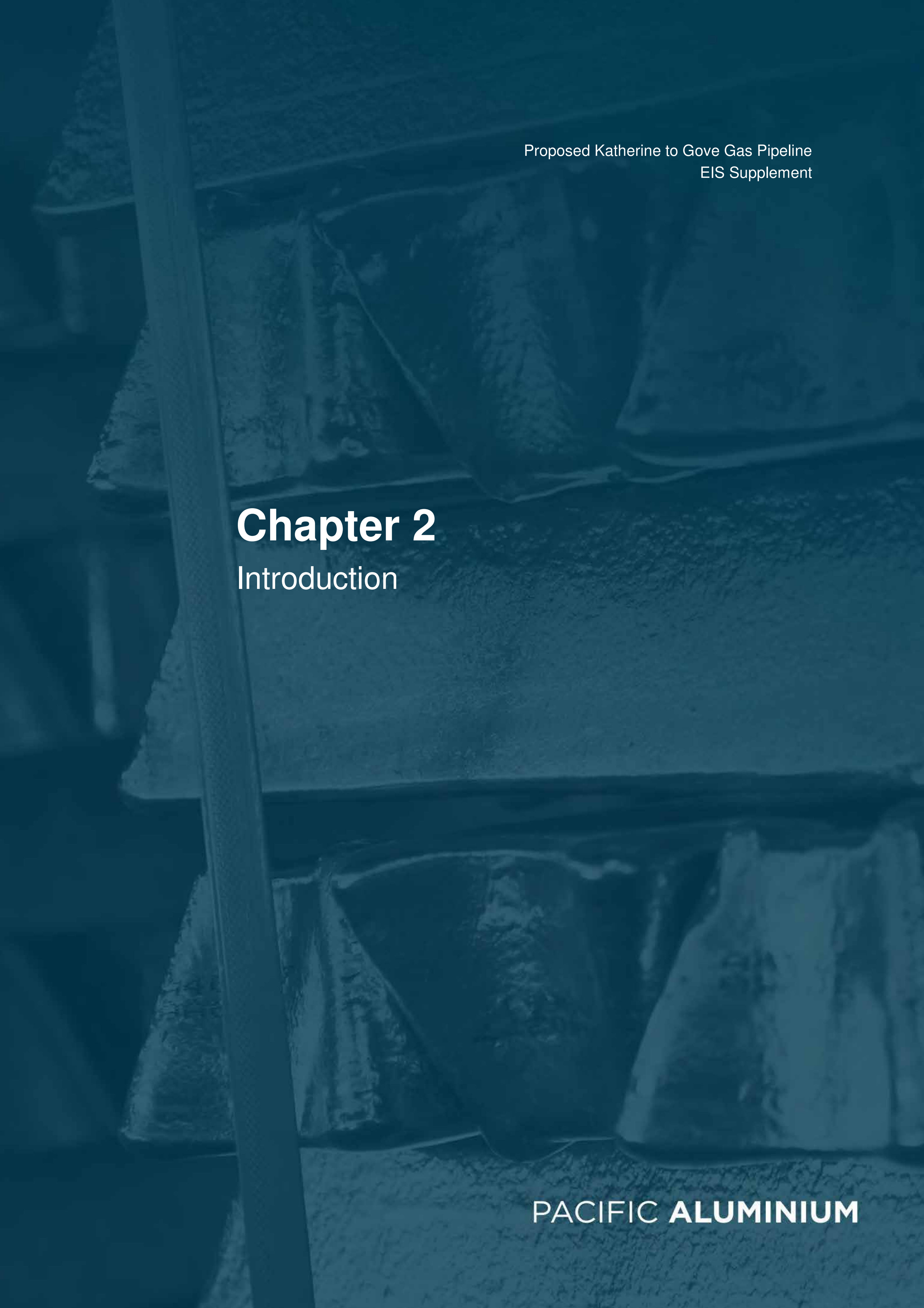


Chapter 2

Introduction

PACIFIC ALUMINIUM

Contents

2 Introduction

2.1 BACKGROUND TO THE PROPOSAL

Pacific Aluminium (a business unit of Rio Tinto) owns and operates a bauxite mine and alumina refinery at Gove, 650 kilometres (km) east of Darwin in north-east Arnhem Land, Northern Territory. High grade bauxite is mined, refined into alumina and then shipped for smelting. Power and steam for the Gove refinery and mining operations are currently generated from imported fuel oil. The delivery of competitively priced gas and conversion of the refinery to gas would help underpin the long term operating life of the refinery and sustain the significant social and economic benefits that accrue to the communities of Nhulunbuy and north-east Arnhem Land; the Aboriginal traditional owners; suppliers and employees.

To ensure the continued operational viability of the refinery, in the face of challenging global market conditions related to high fuel oil prices, exchange rates and a low alumina price, Pacific Aluminium decided in late 2012 to consider sourcing an alternate fuel option for its Gove operations and proposes to construct and operate the Katherine to Gove Gas Pipeline (KGGP) Project.

2.2 ENVIRONMENTAL APPROVAL PROCESS

In November 2012, the NT Environment Protection Authority (NT EPA) determined that, under the NT *Environmental Assessment Act* (the EA Act), the KGGP Project required environmental assessment at the level of an Environmental Impact Statement (EIS). The Commonwealth Government subsequently determined that the KGGP Project was a ‘controlled action’ requiring assessment and approval under the *Environment Protection and Biodiversity Conservation Act* (the EPBC Act) (reference: 2012/6605). The controlling provisions under the EPBC Act are:

- Listed threatened species and communities (sections 18 and 18A).
- Listed migratory species (sections 20 and 20A).

The Commonwealth Government advised Pacific Aluminium on 9 April 2013 that the project will undergo accredited assessment under the NT EA Act. Consequently, the KGGP Project is being assessed under the Northern Territory environmental assessment process and the outcomes of that assessment will be provided to the Commonwealth Government to inform approval processes under the EPBC Act.

2.2.1 Northern Territory environmental approval process

The KGGP will be assessed and approval considered in accordance with the provisions of the EA Act and the *Energy Pipelines Act*, respectively. The key additional approvals and regulatory requirements for construction and operation of the KGGP Project are set out in Section 1.9 of the Draft EIS.

Implementation of the environmental assessment process conducted under the EA Act is the responsibility of the NT EPA and the NT Minister for Lands, Planning and the Environment.

The recommendations flowing from environmental assessment will inform the construction and operational consent required under the NT *Energy Pipelines Act*, issued under the authority of the Minister for Mines and Energy.

Alcan Gove Pty Limited lodged a Notice of Intent (NOI) for the KGGP Project on 5 November 2012 and the NT EPA subsequently determined that an EIS was required.

Draft Guidelines for the preparation of the EIS were then prepared by the NT EPA, establishing the matters that must be addressed in the EIS for the KGGP Project. The Draft Guidelines were publicly released for community comment between 8 and 31 December 2012. The Guidelines were finalised on 14 January 2013 and provided to Pacific Aluminium (Appendix P, of the Draft EIS).

Pacific Aluminium prepared a Draft EIS which it released on 4 May 2013 for a period of eight weeks of community and government comment, with all concerns, queries and other issues submitted to the NT EPA by 28 June 2013. The NT EPA forwarded all submissions on the Draft EIS to Pacific Aluminium, which has prepared this Supplement to the Draft EIS, responding to the issues raised. Together, the Draft EIS and the Supplement constitute the finalised EIS documentation (or the full EIS).

Upon lodgement of the Supplement document by Pacific Aluminium, the NT EPA will prepare an assessment report for the KGGP Project and provide the report to the Minister for Lands, Planning and the Environment. The Minister will provide a copy of the assessment report to the Minister for Mines and Energy to inform decisions on issuing construction and operational consent for the KGGP Project under the *Energy Pipelines Act*. Upon completion of the assessment report for the KGGP, the NT EPA will provide public advice as to where copies of the completed EIS and assessment report can be viewed.

In providing a copy of the assessment report, the Minister for Lands, Planning and the Environment may also make written comment. If the comment is contrary to the assessment report, the Minister must advise the NT EPA why the comment is contrary and table this advice in the Legislative Assembly of the Northern Territory.

The EA Act (section 8A) provides that, if in considering licences for the KGGP Project, the Minister for Mines and Energy makes a decision that is contrary to the assessment report, the Minister must advise the NT EPA as to the reasons and table this in the Legislative Assembly.

2.2.2 Commonwealth environmental approval process

The Northern Territory Minister for Lands, Planning and the Environment will provide a copy of the NT EPA assessment report to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities for consideration in approving the KGGP Project under the provisions of the EPBC Act. The Commonwealth Minister has a period of six weeks to consider the grant of approval unless additional information is required.

Other Commonwealth approval requirements were set out in Section 1.9 of the Draft EIS.

2.3 CONTEXT, STRUCTURE AND FUNCTION OF THE SUPPLEMENT TO THE DRAFT EIS

The key components of this Supplement include:

- Updated and revised details on the project design itself since release of the Draft EIS (Chapter 3).
- Additional environmental information obtained from further survey or additional analyses of vegetation, flora and fauna data completed since publication of the Draft EIS (Chapter 4).
- Additional impact analysis, utilising additional environmental information (Chapter 5).

- Responses by Pacific Aluminium to questions, concerns and comments obtained from the public and government during the eight-week review period (Chapter 6).

The Supplement includes summary tables identifying the individuals, government agencies, non-government organisations, businesses and other groups that made submissions; the issues raised in each submission; and where in the Supplement responses to these issues can be found.

In addition, the Supplement identifies recurring ‘themes’ amongst the submissions, i.e. issues or concerns raised in multiple submissions and therefore comprising key issues that have been addressed by the Pacific Aluminium. A summary response to these key issues is included as well as responses to specific issues raised.

2.4 CONSULTATION

Between January and mid-September 2013 Pacific Aluminium conducted over 100 consultations which are summarised in Appendix E. This consultation took various forms and included EIS consultation forums and information stands, briefings, meetings, field work, telephone calls and teleconferences, and attendance at community events. During these consultations Pacific Aluminium met with a wide range of stakeholders including local, Territory and Commonwealth government agencies, Traditional Owners and communities, pastoralists, businesses and business associations, non-government organisations and associations, and the general public. In addition to these consultations, regular weekly or fortnightly meetings were held with the Northern Land Council (NLC).

The public and government review period on the Draft EIS commenced on 4 May 2013, for a period of eight weeks. During this period Pacific Aluminium held a number of open community forums on the KGGP Project and the outcomes of the Draft EIS and undertook direct consultation with government agencies, non-government organisations and landholders.

2.5 OVERVIEW OF SUBMISSIONS RECEIVED ON THE DRAFT KGGP EIS

The NT EPA received a total of 11 submissions during the review period, all of which came from government agencies and non-government organisations (Table 2-1). No submissions were received from private individuals.

Table 6.1 in Chapter 6 summarises the general issues raised across all of the submissions and indicates the number of times each issue was raised amongst all submissions received.

Key issues raised by respondents are addressed in Chapter 6 and specific responses to each individual issue raised by respondents are included at Appendix A.

2.6 NOTE ABOUT REFERENCES TO KILOMETRE POINTS (KPS) IN THIS EIS SUPPLEMENT

The alignment presented in the Draft EIS and the associated kilometre points (KPs), has been retained in this EIS Supplement as the ‘base case’. This alignment is referred to as ‘Rev A’ in some figures. Where alternative alignment options are discussed, any reference to KPs in relation to these alternative alignments is a reference to the KPs as presented in the Draft EIS. This allows for easy comparison to be made between the information presented in both documents. Subsequent to consideration of the EIS and alignment options presented, the KPs for the finalised alignment would be adjusted accordingly.

Table 2-1: Respondents to the Draft EIS for the Katherine to Gove Gas Pipeline

RESPONSE NO.	COMMENT RECEIVED FROM
1	Department of Defence (Federal)
2	Amateur Fishermen's Association of the Northern Territory
3	Department of Business (Northern Territory)
4	Department of Health (Northern Territory)
5	Department of Transport (Northern Territory)
6	Environment Centre of the Northern Territory
7	Northern Land Council
8	Department of Primary Industry and Fisheries (Northern Territory)
9	Dhimurru Aboriginal Corporation
10	Department of Land Resource Management (Northern Territory)
11	NT Environment Protection Authority (incorporating comment from Federal Department of Sustainability, Environment, Water, Population and Communities)


PACIFIC ALUMINIUM

Chapter 3

Project description update

Contents

3 Project description update

3.1 CLARIFICATION OF PROJECT OBJECTIVES AND SCOPE OF EIS

Section 1.5 of the Draft EIS indicated that the KGGP Project, subject to the scope of the environmental impact assessment, comprised the following elements:

- Construction, operation and eventual decommissioning of a 603 km onshore-buried gas transmission pipeline between south of Katherine and Gove.
- Construction and operation of above ground facilities including a compressor station, meter stations, scraper stations, mainline valves and other ancillary facilities.
- Construction of temporary construction camps.
- Construction of temporary and permanent access roads and laydown areas.

The Draft EIS also indicated that the objectives of the KGGP project are to:

- Maintain and sustainably operate the Gove refinery and mining operations.
- Enable the Gove refinery operation to continue to contribute to the regional, Northern Territory and national economies.
- Deliver an ecologically sustainable development that balances economic, ecological and social outcomes.
- Reduce air emissions from the Gove refinery.
- Comply with legislative requirements.
- Avoid or mitigate environmental and social impacts.
- Rehabilitate the landform in areas disturbed to allow for continued land use in the area traversed by the pipeline.

The above scope and objectives did not explicitly address the decommissioning and/or removal of permanent and temporary components of the project. Accordingly, the following revised scope and objectives are provided.

The scope of the KGGP Project subject to the environmental impact assessment within the EIS comprises the following elements:

- Construction and operation of a 603 km onshore-buried gas transmission pipeline between south of Katherine and Gove.
- Construction and operation of above ground facilities including a compressor station, meter stations, scraper stations, mainline valves and other ancillary facilities.
- Decommissioning of the buried gas transmission line and associated above ground facilities.
- Construction and decommissioning/removal of temporary construction camps.
- Construction and decommissioning/rehabilitation of temporary access tracks and laydown areas and construction of permanent access tracks.

The objectives of the KGGP project are to:

- Provide an affordable energy solution for the Gove refinery.
- Enable the Gove refinery operation to continue to contribute to the regional, Northern Territory and national economies.

- Deliver an ecologically sustainable development that balances economic, ecological and social outcomes.
- Reduce air emissions from the Gove refinery.
- Comply with legislative requirements.
- Avoid or mitigate environmental and social impacts.
- Rehabilitate the landform in disturbed areas to allow for continued land use in the area traversed by the pipeline and areas used for temporary infrastructure (such as construction camps and access tracks).

Consistent with this revised scope and objective, section 3.9 of this EIS Supplement provides additional detail around the decommissioning/removal of temporary and permanent components of the project.

3.2 TWO-YEAR BUILD OPTION

The Draft EIS provided the following key milestones for construction of the KGGP:

2012-13	Environmental and land access approvals finalised.
2013	Engineering design.
2014	Pipeline construction.
2015	Gas delivery to the Gove refinery.

Under the above schedule (and depending on statutory approvals and weather conditions), construction would be undertaken between February 2014 and December 2014 with the majority of construction activities ramping up in March 2014 and peaking between July and August. Peak workforce numbers have been estimated to be in the order of 980 workers. Under the one year build put forward in the Draft EIS, construction would be undertaken in two sections or 'construction spreads' primarily over the 2014 dry season and first free flow gas to Gove would be achieved by the first quarter 2015 and the refinery would be fully converted to gas in early 2016.

Further design and planning for the KGGP Project has necessitated consideration of a two-year build option as follows:

- 2014: one construction spread commencing at the Katherine end of the alignment (KP0) and constructing as much completed pipeline as practicable within the dry season (anticipated 300-400 km completed). It is anticipated that construction would commence in early February 2014 and cease with the onset of the wet season approximately at the end of November 2014.
- At the end of the 2014 build period, areas disturbed by the constructed pipeline would be reinstated and the constructed pipeline section made safe to the elements. Topsoils would be respread as set out in the Provisional Rehabilitation Management Plan. Hydro-tested sections would be connected together and any pipe 'open ends' would be sealed to prevent access of fauna, debris or dust. This procedure is common for unfinished pipelines.
- 2015: one construction spread commencing at the point of 2014 pipeline completion, and construction of the balance of the pipeline towards Gove. Construction would re-commence around February 2015 and would likely finish in November 2015.
- First gas delivery and full refinery conversion would likely occur in January 2016.

- The pipeline construction methodology between a one year (2014) build period and a two-year (2014/2015) build period will not change other than the gas delivery date shifting by one year. The same construction techniques and environmental management measures will apply and the project will be staffed with the appropriate numbers of environmental and cultural heritage personnel to execute the work over two years.
- The total workforce 'man days' to complete the pipeline are estimated to be similar for both the one and two-year build option. Peak workforce numbers for the one year build are estimated to be in the order of 980 workers whilst in the two-year build the peak workforce numbers in each year are estimated to be in the order of 650 workers.
- Due to lower peak workforce numbers in the two-year build option, transport and people movements both along the Central Arnhem Road and elsewhere would be less in each of the two construction periods.

The key effect of the two-year build is to spread the construction effort out over a longer period, however the location, extent and timing (within the year) of disturbance associated with the project is no greater.

An assessment of the key potential impacts of a two-year build in comparison to a one year build has been undertaken. The comparative assessment focussed primarily on those risks rated as 'Moderate' or higher in Chapter 5 of the Draft EIS. A summary of this assessment is provided at Appendix B. A two-year build makes no material difference to the predicted environmental outcomes against the key risks presented for a one year build, as presented in the Draft EIS. All key potential impacts for bio-physical environmental factors would remain the same or be no greater under a two-year build compared to those predicted for a one year build. Socio-economic benefits such as training and employment for locally sourced workers could potentially be less under a two-year build due to the smaller total workforce.

Pacific Aluminium seeks to keep either construction option available during the design phase of the project.

3.3 ALTERNATIVE ALIGNMENT OPTIONS

During the course of further design work for the KGGP project, a number of adjustments to the proposed alignment of the KGGP have been made. Further details are provided below. A Final Alignment Plan (or Plans in the event of a two-year build) will be submitted to DSEWPaC and the NT EPA advising of the finalised proposed alignment in respect to the realignment options.

3.3.1 Minor adjustments to accommodate road reserve

In order to avoid the road reserve associated with the Central Arnhem Road, minor adjustments to the alignment are proposed in a number of locations. These minor deviations are no greater than 150-200 m from the previously proposed alignment. Given the minor nature of these changes, they are not expected to change the predicted environmental outcomes presented in the Draft EIS and are not discussed further.

3.3.2 Realignment of the NT Amadeus Basin tie-in

A possible alternative alignment for tie-in of the KGGP to the NT Amadeus Pipeline was foreshadowed in the Draft EIS (section 2.3). Under this alignment option the pipeline start point and the pipeline route to the Stuart Highway has been relocated to a more southerly location to avoid a rail crossing and to reduce the number of properties the pipeline passes through (Figure 3-1). The overall pipeline length is reduced by approximately 10.5 km with this change. The tie-in point to the NT Amadeus Pipeline would also be moved south to coincide with this location. Under this option, it is also proposed to move the King River Compressor Station from the site described in the Draft EIS to a location described in section 3.5.1.

Figure 3-1: Realignment of the NT Amadeus Gas Pipeline tie-in

3.3.3 Proposed deviation at Beswick Creek to avoid multiple river crossings (KP60-KP62)

The original alignment of the crossing of Beswick Creek involved three watercourse crossings. It is proposed to relocate the alignment to:

- Avoid multiple crossings of the same watercourse.
- Cross at a single upstream location to ensure a shorter crossing width.
- Relocate south to avoid low lying areas subject to flooding (Figure 3-2).

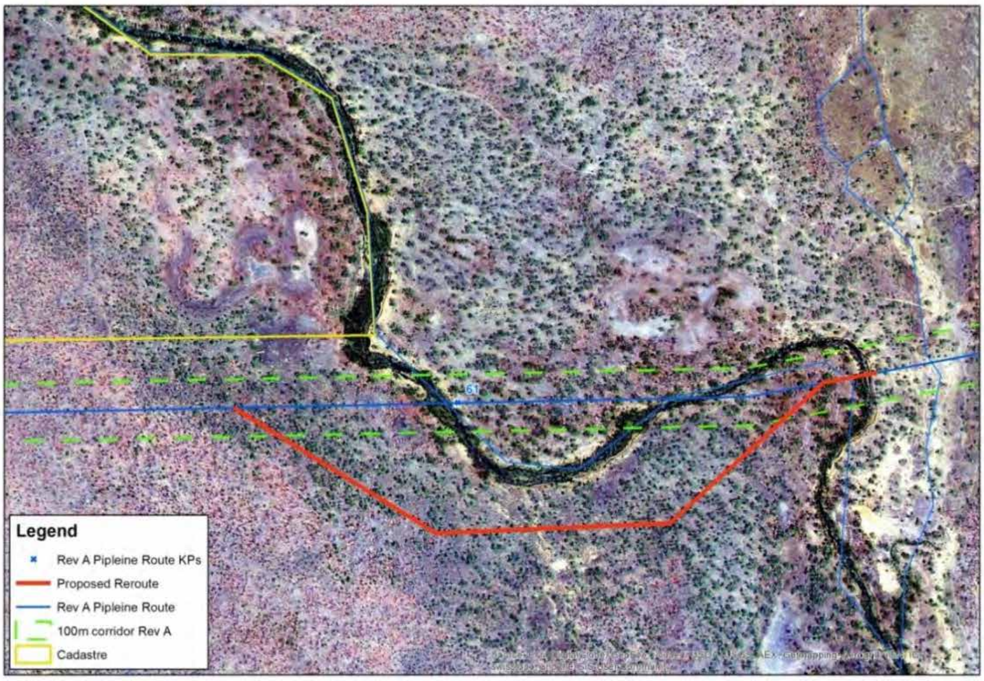


Figure 3-2: Proposed deviation of the pipeline to avoid multiple crossings of Beswick Creek

3.3.4 Mitchell Ranges realignment (KP396-KP435)

The Draft EIS indicated landholder consent was yet to obtained for an unsurveyed area to the north of the Mitchell Ranges. Consent was subsequently obtained for a survey and the results of flora and fauna surveys along the proposed alignment are included in Chapter 4 of this EIS Supplement.

Traditional owner consent for the currently proposed alignment has not been received and following discussion with the NLC an alternative alignment is under investigation and negotiation with the appropriate Aboriginal traditional owners. Following vegetation mapping and field investigation, the broad environmental values associated with this alternative alignment have been evaluated (particularly as they relate to Matters of NES) and the results of that evaluation (together with the likely location of the alignment) are presented in section 5.15 of this EIS Supplement. If this alignment option is pursued, Pacific Aluminium commits to undertake further flora, fauna (including habitat mapping for Gouldian Finch, Red Goshawk and other relevant species comprising Matters of NES) and cultural heritage surveys to inform management options and prior to commencing construction in the area of the alignment option. A report accompanying the Final Alignment Plan(s) would be submitted to DSEWPaC and the NT EPA addressing how impacts to the following have been avoided in the selection of the final alignment:

- Vegetation representative of the Arnhem Plateau Sandstone Shrubland Threatened Ecological Community (TEC).
- Known, likely or potential critical, regionally significant and/or locally restricted habitat for threatened and/or migratory species listed under the EPBC Act or TPWC Act.
- Sites of archaeological or cultural heritage significance (noting that the provisions of the NTASS Act and Heritage Act in respect of Aboriginal sacred sites and declared heritage places and objects will apply and be complied with).

In the event that any of the above matters are not able to be avoided through adjustments to the alignment or working width of the ROW, Pacific Aluminium would propose an environmental offset

sufficient to mitigate the residual impact to the relevant matters. This would be detailed in the report accompanying the Final Alignment Plan including a description of measures to minimise and manage impacts to these species during and following construction.

3.3.5 Realignment around mining lease MLN955 (KP581-KP588)

A short deviation is proposed between KP581 and KP588 in order to avoid potential longer term resource reduction impacts on Pacific Aluminium's bauxite mining lease (MLN955)(Figure 3-3). The predicted environmental outcome for vegetation communities should this realignment be implemented is not expected to be significant and is addressed in section 5.1.5 of this EIS Supplement.

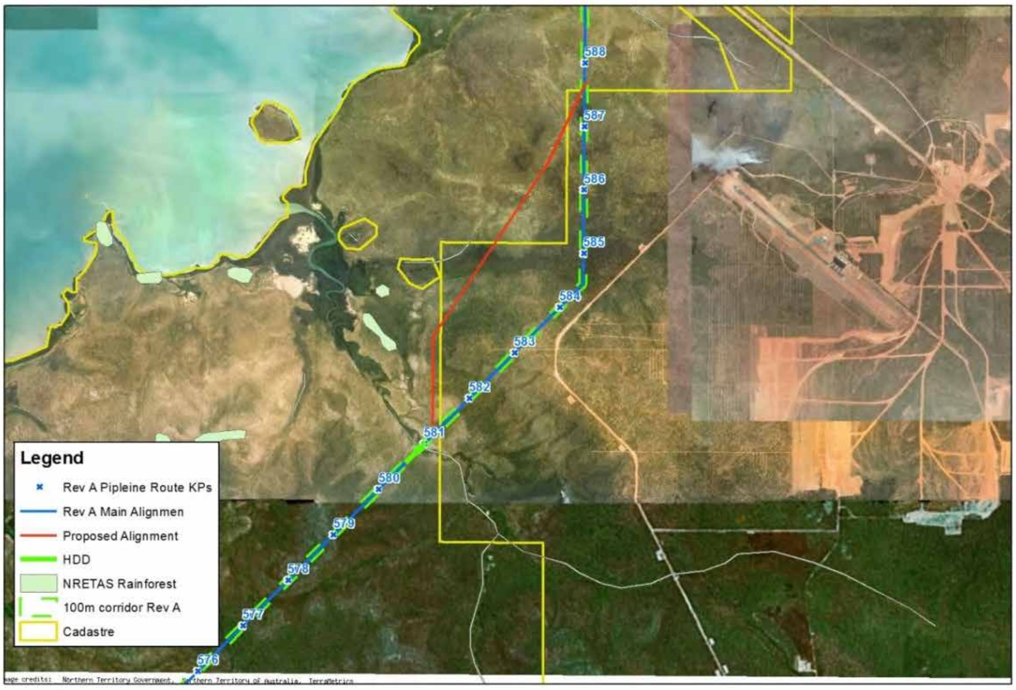


Figure 3-3: Proposed re-route of the pipeline at KP581-KP588 to avoid expected areas of mining expansion within the mining lease MLN955

3.3.6 Boggy Creek (KP505-KP519)

During the course of ongoing consultation with Aboriginal traditional owners, a request was been made to realign the pipeline corridor away from a site of cultural significance. The Aboriginal traditional owners have requested that the alignment be shifted further south between KP505 and KP519. The proposed re-alignment would cross Boggy Creek a little under one kilometre south of the current alignment. Boggy Creek has been proposed to be crossed using HDD techniques and the proposed re-alignment would not alter this arrangement. Following consultation with the NLC, it was agreed to relocate the pipeline alignment directly between KP505.5 (after the Gurramuru outstation) and KP519 (Figure 3-4).

The predicted environmental outcome for vegetation communities should this realignment be implemented is not expected to be significant and is addressed in section 5.1.4 of this EIS Supplement.

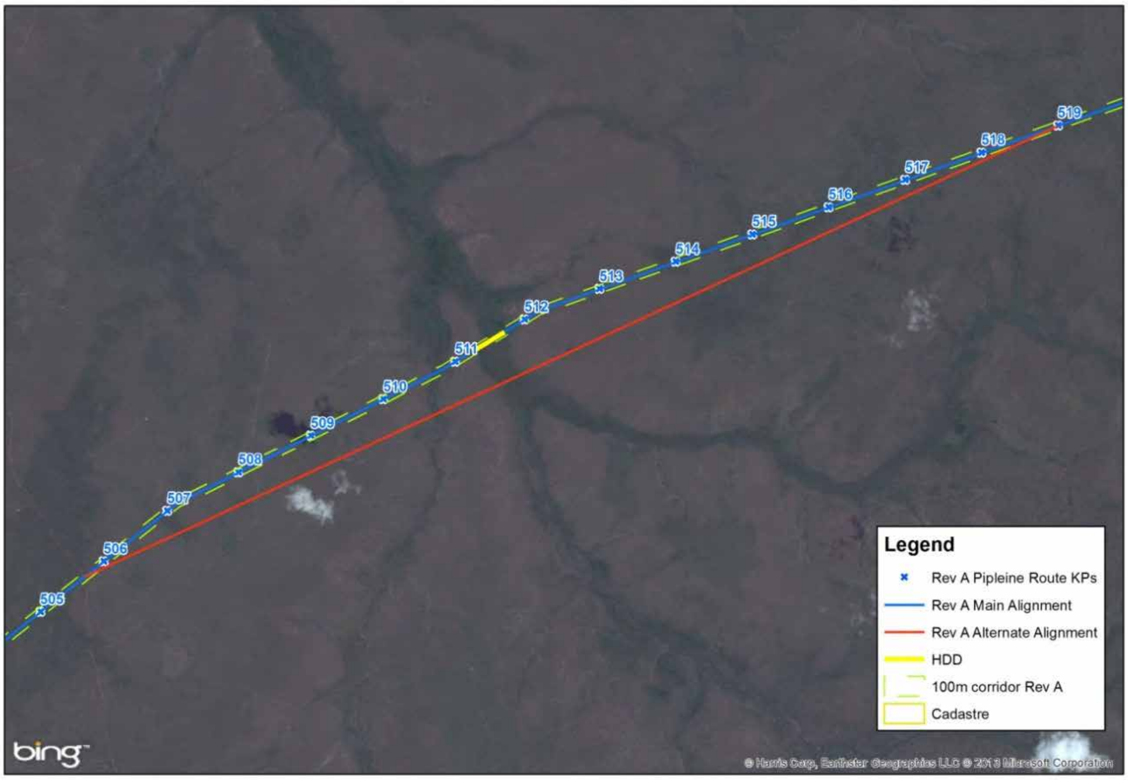


Figure 3-4: Proposed realignment near Boggy Creek

3.4 POSITIONING OF THE ROW WITHIN THE PIPELINE CORRIDOR AND REDUCED WORKING WIDTH

Additional consideration of options for minimising disturbance of key environmental values or important habitat for threatened species has identified the following options that will be implemented to further avoid or minimise disturbance by removal of native vegetation to establish the ROW.

At the time of survey and pegging of the 30 m ROW within the 100 m pipeline corridor, all opportunities to avoid identified habitat trees important for breeding of Gouldian Finch, Red Goshawk and Northern Crested Shrike-tit will be undertaken by fine scale realignment of the ROW within the pipeline corridor. A qualified ecologist would be on-site to assist in identifying habitat trees and the appropriate position of the ROW within the pipeline corridor.

Consideration will be given to reducing the working width of the ROW in those areas identified above to minimise the removal of identified habitat trees, where options for realignment of the ROW within the pipeline corridor cannot avoid disturbance.

Section 5.6 provides more details of the implementation of the above in respect of key habitat requirements for the Gouldian Finch.

The processes of avoiding and minimising disturbance to key habitat requirements for threatened species described above would be supported by the establishment and use of Alignment Sheets by the construction contractor.

The Alignment Sheets provide detailed location-specific information regarding the pipeline design and surrounding environmental and cultural heritage aspects that inform the design and construction process, and include a legend for understanding symbols and defining the nomenclature. Each Alignment Sheet generally includes aerial imagery and detailed information for approximately a three to four kilometre section of pipeline (i.e. there would be approximately 180 Alignment Sheets for the entire KGGP). The Alignment Sheet Specification provides details of the engineering design criteria used to develop the Alignment Sheets

The construction contractor will use the Alignment Sheet documentation together with other engineering documents (including pipeline standard drawings, special crossing drawings and construction specifications) to construct the pipeline. The ROW constraint details provided on the Alignment Sheets will inform construction decisions where on-site conditions require alteration from the proposed design. This will assist in the avoidance and minimisation of adverse impacts to sensitive environmental and cultural values. The Alignment Sheets will form a living document from design through to construction and operation and will record construction decisions and ‘as-built’ final locations of the pipeline and associated infrastructure.

Details of the information typically recorded on the Alignment Sheet are provided below.

Pipeline design aspects include:

- Pipe type (material specification, wall thickness, coatings etc.).
- Signage.
- Cathodic protection.
- Location of pipe bends.
- Buoyancy control measures.
- Depth of cover.
- Additional protection.
- Reference design drawings.

Other details:

- Environmental aspects such as protected vegetation, fauna habitat, sensitive watercourse crossings.
- Cultural aspects including AAPA restricted work areas.
- Elevation profile.
- Property details.
- Location of existing infrastructure such as roads, rail, power and water supply.

3.5 ABOVE GROUND SUPPORTING INFRASTRUCTURE

Section 2.5.4 of the Draft EIS sets out the above ground supporting infrastructure required for the KGGP. During design further consideration has been given to the locations of these components of the KGGP Project.

3.5.1 Relocation of compressor station

With a change to the tie-in alignment, the compressor station would be sited approximately 23 km south-west of the location presented in the Draft EIS as shown in Table 3-1. The proposed relocation has the following benefits:

- Reduced hydraulic losses resulting from relocation of the compressor station to the start of the pipeline.
- Higher expected inlet pressures at the compressor station leading to lower compression requirements.
- Fewer required facility sites as the proposed site would be co-located with the off-take facility and proposed meter station facility.

The location of the compressor station for the alternate tie-in, relative to that proposed in the Draft EIS is shown in Figure 3-5.

The alternative location for the compressor station is located approximately 5.5 km from the closest sensitive receptor (group of single dwellings) as identified in the air quality and environmental noise assessments in the Draft EIS. The predicted air and noise impacts associated with the compressor station are expected to be no greater than those reported in the Draft EIS as outlined below:

- Appendix L (section 7.1.2) of the Draft EIS states that ‘The predicted noise levels at the nearest sensitive receptors to the compressor station facility would be below LA10 27 dB as no sensitive receptors could be found within a five kilometre radius of these operations. This noise level (including the correction of plus five decibels for tonality) is compliant with the criteria for all periods contained within the noise regulations’.
- Appendix G (section 7.2) of the Draft EIS states that the maximum predicted levels of Pollutants of Potential Concern (POPCs) ‘emitted by the proposed King River compressor station during operation of the Katherine to Gove Gas Pipeline project are all well below their relevant assessment criteria. Taking into account, both the low impacts and the large distances to the nearest human health receptors, the operation of the pipeline is considered to present minimal risk to human health’.

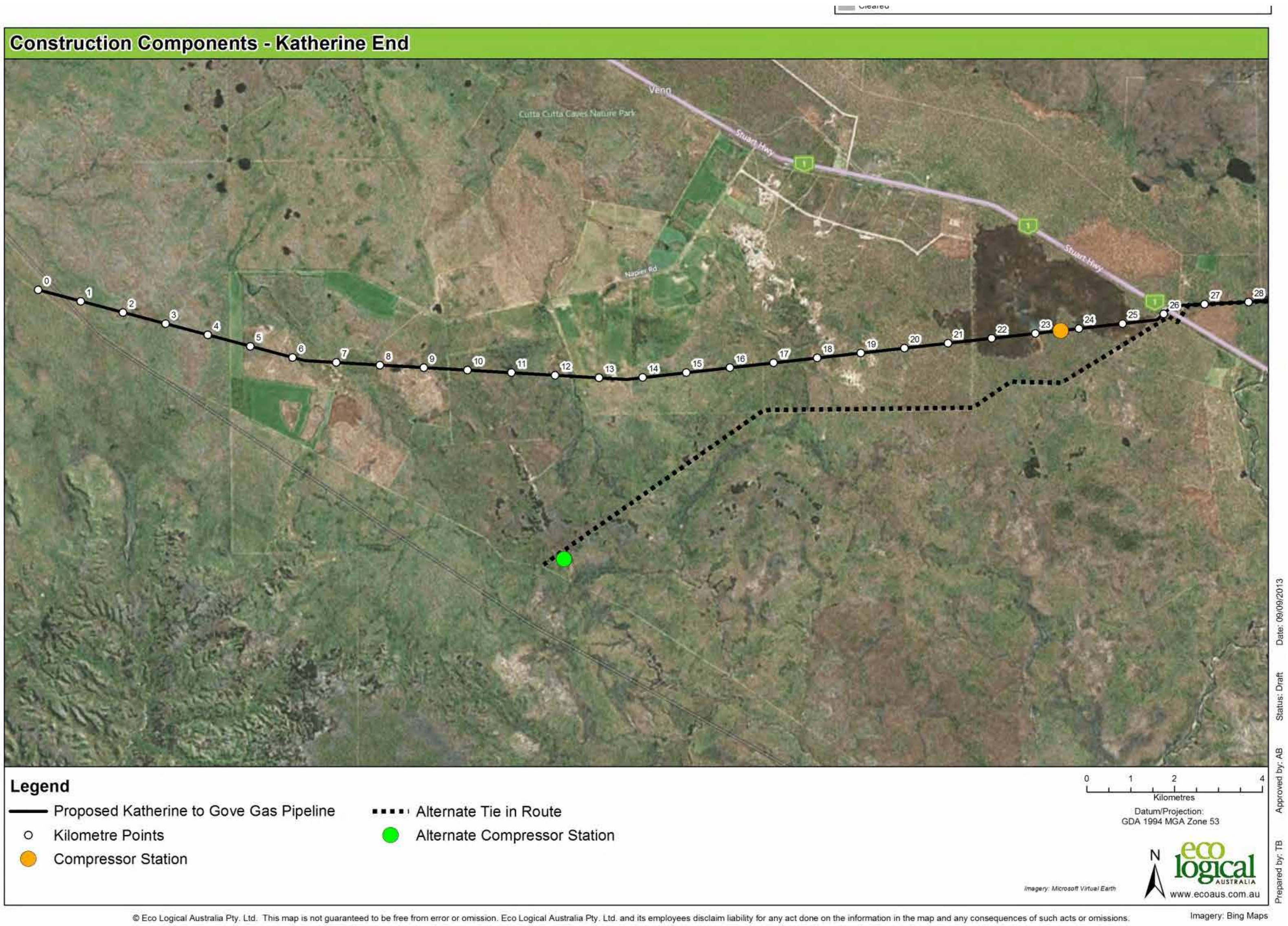


Figure 3-5: Location of proposed compressor station sites for originally proposed and alternative tie-in alignments

3.5.2 Relocation of mainline valve (MLV) sites

The project's pre-feasibility phase defined a mainline valve spacing of 155 km. During the early feasibility phase, further analysis and refinement of the assumptions has led to a decrease in spacing to 140 km. As such, the mainline valve originally proposed to be located at KP193 has been moved to KP143 (and is hence forth known as MLV1), the MLV at KP456 has been relocated to KP443 (and renamed as MLV3), and the MLV at KP591 is relocated to KP582 (and is to be known as MLV4). MLV2 is co-located with the Annie Creek scraper station and its location remains as described in the Draft EIS.

For each of these mainline valve stations, there will be an additional enclosure (of approximately 10 m x 10 m) located approximately 30 m away from the MLV fence housing the MLV vent. This offset is a requirement for operator safety. Around this enclosure, a fire break of at least 15 m will be provided.

3.5.3 Relocation of remote cathodic protection station sites

The Draft EIS did not include additional remote cathodic protection (CP) sites as CP stations are usually co-located with the MLV sites. The proposed MLV spacing is now such that intermediate CP stations are required to provide sufficient current to adequately protect the pipeline. Therefore remote CP stations would be required at KPs 100, 195, 397 and 505. A CP station is also proposed to be co-located at the MLV 2 facility site.

The Remote CP Stations would be contained within the ROW and would occupy an area of approximately 20 m x15 m and would also require an anode groundbed installation. The location of the anode ground beds are under investigation and may be located at up to 500 m away from the pipeline ROW and would require a permanent five m wide corridor for an access track and to lay a cable out to the ground bed. The ground bed would be a permanent installation for the life of the pipeline and would occupy an area of approximately 60 m x 10 m.

As set out in the Draft EIS, the specific siting of ancillary infrastructure including CP sites would be determined using the Site Selection Protocol (Draft EIS, Appendix U). In addition a soil resistivity survey will be undertaken to inform the preferred location of the ground beds.

3.5.4 Summary

The revised locations are summarised in Table 3-1. These locations will be further refined during the detailed design phase. The changes set out and any further required adjustments are not expected to materially alter the predicted environmental outcomes.

Table 3-1: Adjusted locations of supporting infrastructure for the KGGP

METER STATIONS		MAIN LINE VALVES		SCRAPER STATIONS		COMPRESSOR STATION	
Draft EIS	Current	Draft EIS	Current	Draft EIS	Current	Draft EIS	Current
KP602.7	KP602.7	KP192.5	KP143	KP0.0 (Tie-in)	KP16 (Rev A Alternate)*	KP23.6 (King River)	KP16 (Rev A Alternate)*
		KP297.0	KP297	KP297.0	KP297.0		
		KP456.0	KP443	KP602.7	KP602.7		
		KP574.5	KP586				
		KP590.9	N/A				

* 'Rev A Alternate' refers to alternate tie-in alignment and associated revised KPs for that section

3.6 ACCESS TRACKS

The Draft EIS indicated that approximately 265 km of existing access tracks and 110-150 km of new access tracks may be required to assist in the construction of the KGGP. During the course of design, the access requirements for the project have undergone further evaluation. Under current design conditions it is expected that approximately 230 km of existing access tracks and 152 km of new access tracks would be required during construction of the KGGP Project. Recent field investigations (July/August 2013) have assessed the condition of existing access tracks and identified that the majority will require upgrading including additional native vegetation clearing. This has been included in the revised disturbance area (section 3-8 of this EIS Supplement).

As set out in the Draft EIS, any access track not required during the operational phase or requested to remain by the landowner would be rehabilitated, consistent with the Provisional Rehabilitation Management Plan (Appendix O).

Measures to potentially reduce the length of required access tracks (and associated vegetation clearing) are currently under consideration as part of detailed design planning. This includes the use of temporary bridges across watercourses that would allow movement of equipment and personnel to additional lengths of the ROW, reducing the need for some access tracks connecting to the Central Arnhem Road. The use of temporary bridges is an accepted industry practice. No infrastructure is placed in-stream and the location of crossing points would be carefully selected to minimise any disturbance to riparian vegetation and to the watercourse bank. The temporary bridge would be removed after completion of works.

The following expanded commitment is provided in respect of access tracks.

Pacific Aluminium will ensure that prior to construction the proposed locations of access tracks and construction camps are subject to vegetation/habitat mapping, searches for threatened and/or migratory species listed under Territory or Commonwealth legislation; and heritage surveys. Within six months of completion of construction, Pacific Aluminium will submit a Final Access Track and Construction Camp Summary Report to the NT Government and DSEWPaC demonstrating how the access tracks/camps were designed and constructed to avoid and mitigate impacts to:

- Vegetation representative of the Arnhem Plateau Sandstone Shrubland Threatened Ecological Community (TEC).
- Known, likely or potential critical, regionally significant and/or locally restricted habitat for threatened and/or migratory species listed under Territory or Commonwealth legislation.
- Sites of archaeological or cultural heritage significance.

The Final Access Track and Construction Camp Summary Report will also describe how the following other management considerations have been taken into account:

- Sensitive habitat such as wetlands, monsoonal rainforest, melaleuca forest, or riparian vegetation.
- Major weed infestations.
- Sites of Yellow Crazy Ant infestation.
- Highly erodible soils.
- Flood prone areas.
- Minimisation of the overall disturbance area for access tracks to as low as possible.

The Final Access Track and Construction Camp Summary Report will indicate those access tracks, or parts there-of, that are not required post-construction and detail how these and the construction camp sites have been, or are in process of being, rehabilitated following construction. The total area of clearing for construction camps and access tracks is not expected to exceed 367 ha.

3.7 CONSTRUCTION CAMPS

The Draft EIS indicated five temporary construction camps would be established to house and support workers during the construction of the KGGP. The number of construction camps proposed would remain the same under either a one or two-year build for the pipeline.

As set out in the Draft EIS, the specific siting of the construction camps at these locations would be determined using the Site Selection Protocol (Draft EIS, Appendix U). Additional commitment regarding avoidance of sensitive habitat and other environmental and cultural values in the siting of construction camps and reporting on the outcomes of those measures, is expanded upon in Chapter 6. Existing cleared or degraded areas would be used as far as practicable for the siting of construction camps but additional clearing for construction is likely to be required and this has been accommodated in the adjusted native vegetation disturbance area for the project set out in section 3-8 of this EIS Supplement.

All camps would be temporary. Gravels imported to the site would be returned to the nearest borrow pit and all hardstand such as concrete foundations would be removed or crushed on-site and covered with top soil. Rehabilitation of the camp sites would be as set out in the Draft EIS and the Provisional Rehabilitation Management Plan at Appendix O.

3.8 NATIVE VEGETATION CLEARING

Section 2.6.11 of the Draft EIS provided a summary of the disturbance area (clearing of native vegetation) for the KGGP Project. This has been refined during the design phase and the disturbance area adjusted to accommodate additional access track (new and upgraded: see section 3.6 of this EIS Supplement) (Table 3-2). Clearing indicated for the ROW accommodates possible implementation of the alternative alignments detailed in section 3.3.

The Draft EIS estimated that up to 2,200 ha of native vegetation would be removed during construction of the KGGP of which up to 1,365 ha was anticipated to return to native woody vegetation over time through a combination of natural regrowth and active rehabilitation. Following revision of the clearing required it is now estimated that up to 2,316 ha of native vegetation would be removed during construction of the KGGP of which up to 1,398 ha is anticipated to return to native woody vegetation over time through a combination of natural regrowth and active rehabilitation.

3.9 DECOMMISSIONING

The decision to decommission the pipeline and associated ancillary infrastructure will be undertaken with reference to a risk assessment including economic, social, safety, technical feasibility, regulatory requirements and environmental factors and in consultation with regulators and other stakeholders. The APIA Environmental Code of Practice (section 8) provides guidance on decommissioning activities and shall be consulted in the development of the decommissioning plan.

Table 3-2: Revised disturbance area for the KGGP Project

ACTIVITY	COMPONENTS INCLUDED	LIKELY DEVELOPMENT IMPROVEMENT	LIKELY AREA (PROPORTION) TO RETURN TO NATIVE WOODY VEGETATION
KGGP ROW	• Clearing 30 m wide for the length of the pipeline • Turning bays • Additional ROW working width at water crossings	1,840 ha	1,104 ha
Ancillary infrastructure	• Stockpiles • Compressor station • Mainline valves • Scraper stations • Anode beds • Meter station	27 ha	25 ha
Temporary infrastructure	• Construction camps • Laydown areas • Evaporation ponds	154 ha	154
Construction access	• Access tracks (new:152 km; upgrade existing tracks: 230km) • Borrow pits	295 ha	115 ha
TOTAL		2,316 ha	1398 ha

The decommissioning plan for the KGGP will be supported by a decommissioning study which will address the relevant aspects including:

- Potential reuse options.
- Age and length of the pipeline.
- Existing environment and land use.
- Regulatory requirements.

The planning would assess the feasibility of pipeline removal, although it is generally acknowledged that this would not be the preferred option from an economic or environmental perspective as it would necessitate considerable ground disturbance. Section 8.3 of the APIA Code of Environmental Practice states that ‘abandoning buried pipelines *in situ* is environmentally preferable to pipeline removal as a decommissioning strategy, due mainly to the disturbance associated with the excavation and removal of the pipeline”.

As stated in Appendix O of the draft EIS: ‘Both suspension and in situ options involve disconnecting the pipeline from the system. The suspension option involves filling the pipeline with an inert material, such as nitrogen, and maintaining as per an operating pipeline. The in situ option involves disconnecting the pipeline from the cathodic protection system and leaving the pipeline to degrade. If the in situ option was adopted all above ground facilities and supporting structures would be removed and these areas reinstated’. ‘The remaining disturbed areas along the ROW would be rehabilitated with the objective of returning the area to a condition consistent with the landholder’s intended use for the land’.

The methodology for decommissioning would include:

1. Decommissioning preparation.
2. Product removal and pipe cleaning.
3. Removal of CP facilities.
4. Removal of above ground infrastructure (if required).
5. Rehabilitation of above ground facility sites.

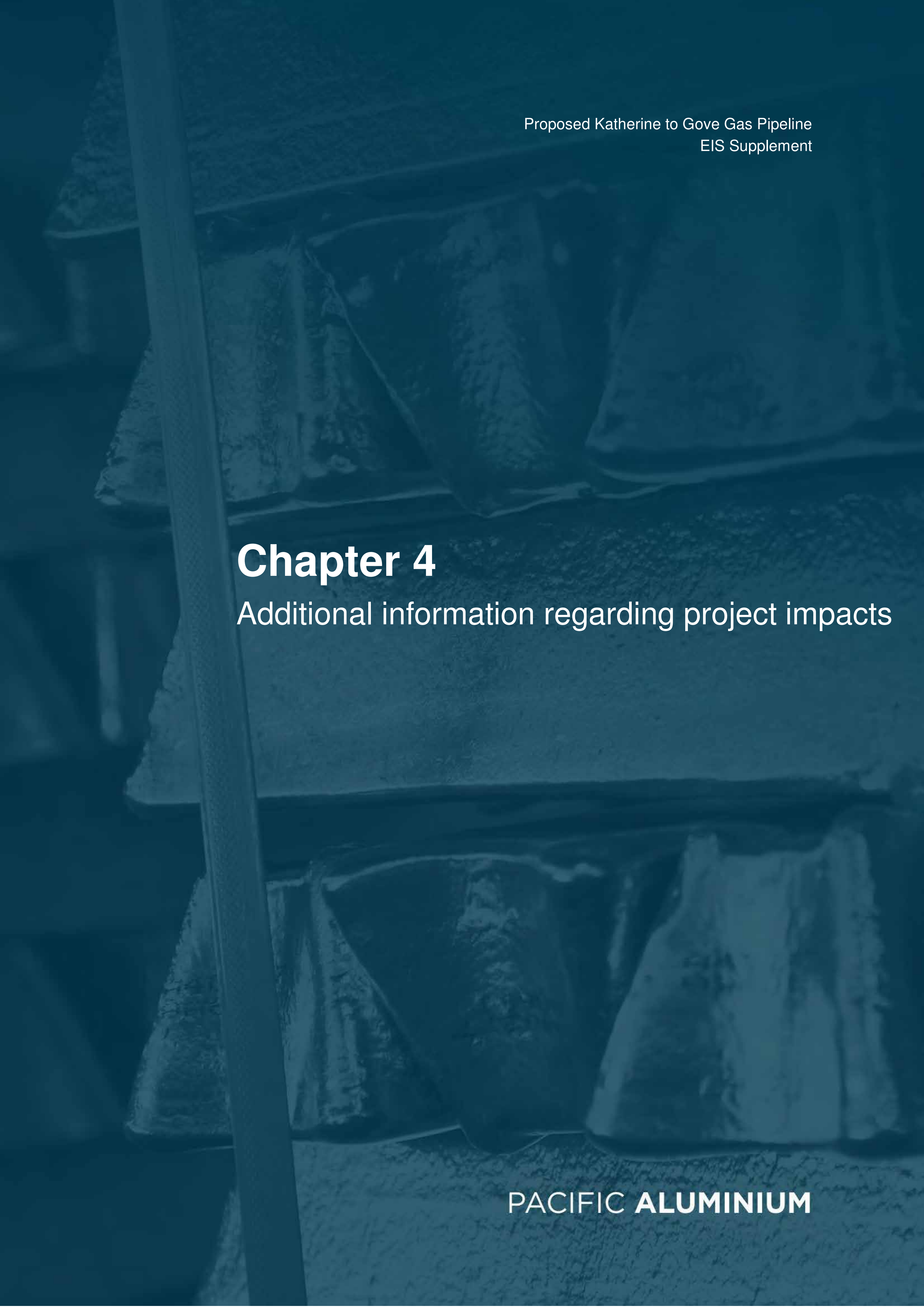
Removal of the above-ground infrastructure would be undertaken in accordance with the relevant Australian standard (currently AS2885) and approved KGGP Decommissioning Plan.

Compressor station equipment, mainline valves and other ancillary infrastructure would be dismantled and either salvaged for reuse or disposed of as scrap, depending on condition, relative cost and demand.

Upon the removal of facilities, the land would be reinstated and rehabilitated in accordance with the Operational/Decommissioning Environmental Management Plan (OEMP).

The removal and rehabilitation of access tracks would be undertaken in consultation with the traditional owners / landowners. In cases where the landowners no longer require the access tracks, they would be similarly reinstated and rehabilitated in accordance with the OEMP.

PACIFIC **ALUMINIUM**



Chapter 4

Additional information regarding project impacts

PACIFIC ALUMINIUM

Contents

4 Additional information regarding project impacts

This section presents additional information relevant to the impact analysis presented in the Draft EIS.

Coarse scale vegetation mapping was presented in the Draft EIS. To assist in better defining the habitats within the project area, additional finer scale vegetation mapping has been conducted across the length of the pipeline corridor, using a mixture of remote sensing techniques and the findings of the vegetation surveys conducted for the Draft EIS. This is described in section 4.1 and the vegetation maps are presented at Appendix C to the EIS Supplement**.** Detailed vegetation mapping of a number of possible realignment options was also undertaken and the results presented in Chapter 5.

The Draft EIS presented detailed flora and fauna survey information across the majority of the KGGP corridor. A small (40 km) section of the pipeline corridor to the north of the Mitchell Ranges was not surveyed as landholder consent had not, at the time, been obtained. The Draft EIS indicated this area would be surveyed and with landholder consent obtained, the survey was conducted in May 2013. The results of this survey and analysis of potential environmental impacts are presented in sections 4.2 and 4.4.

The Draft EIS indicated that the threatened plant species *Pternandra coerulescens* was known to occur within 750 m of the proposed pipeline centreline. Given the close proximity and potential for dispersal of the plant in the period since earlier surveys were undertaken, additional targeted survey for this species was conducted and the results presented in section 4.3.

A significant population of Gouldian Finches was recorded in the vicinity of the pipeline corridor during the terrestrial fauna survey conducted during November 2012. The results of this survey and the analysis of potential impacts from the construction of the KGGP were presented in the Draft EIS along with a commitment to further examine the critical resource requirements of this species in the area between KP0-140. This survey was conducted in May 2013 and the results are presented in section 4.5.

Survey methodologies and results are included in full in the sections below. In some instances survey site descriptions have been summarised, however full descriptions are available on request.

Additional archaeological survey of the pipeline ROW in the vicinity of the Mitchell Ranges and a number of alternative alignment options, the access tracks and construction camps had not been undertaken at the time of the preparation of this EIS Supplement. These surveys will be undertaken prior to clearing activities and the requirements of the *Heritage Act* in respect to any required disturbance of archaeological material will be adhered to.

4.1 UPDATED INFORMATION ON VEGETATION COMMUNITIES

4.1.1 Introduction

Existing vegetation mapping for the remote location traversed by the proposed pipeline route, from Katherine to Gove in north east Northern Territory, is generally only available at relatively large (state and national) scales. For example, the map 'Vegetation of the Australian Tropical Savannas' (Fox et al. 2001) was produced at 1:2,000,000 and the NVIS - National Vegetation Information System, NT Data Compilation (DLRM 2000) coverage for the proposed pipeline route was prepared at 1:250, 000. Other finer scale datasets do exist, such as the 'Vegetation Mapping of the Daly River Catchment' (Cuff 2011), however these only cover small portions of the entire proposed pipeline route and therefore their application to the KGGP project is limited.

Utilising the above broad scale datasets to assess site-specific impacts has inherent limitations, such as the inability to identify small scale landscape features (such as small or restricted vegetation types) and the broad nature resulting in generalisation of spatial (linework) and attribution (vegetation classification) details.

In order to improve the assessment of potential impacts of constructing the KGGP on vegetation types and species habitats, finer scaled vegetation mapping within a one kilometre buffer of the proposed pipeline centreline was undertaken. More detailed mapping was also carried out for the previously unsurveyed section of the Mitchell Ranges. The approach was mostly desktop based utilising high resolution digital aerial photographs and available supporting information.

4.1.2 Methods

Data exploration

Prior to conducting desktop vegetation mapping, a review of relevant data and supporting information was undertaken and available datasets were compiled, assessed and prepared (Table 4-1).

As expected, the review found distinct data deficiencies in the availability of finer scaled vegetation information along the pipeline. However, four main datasets containing vegetation specific information were identified and used to guide vegetation delineation and attribution.

The first dataset consisted of survey information obtained from the 2004 flora surveys (EcOz 2004). This dataset was found to have the greatest coverage of vegetation community information as spot point locations along the pipeline and as such, was the most heavily utilised in the mapping process. Although, it was found to be the best source of validated information, the flora surveys were constrained to roughly five kilometre intervals along the linear pipeline, therefore this information was only site-specific and as a result, could only be extrapolated to nearby polygons or in some instances, no further than the immediate polygon feature. The vegetation classification scheme used in the EcOz 2004 flora surveys also differed to that of the NVIS classifications which resulted in the need to interpret and attempt to standardise the information into the NVIS classification system. While this was undertaken for NVIS Level 3 classifications, any more detailed Level 4 information was not standardised into the digital dataset. NVIS is a nationally recognised standard for surveying, classifying and mapping vegetation communities. The standard allows for vegetation communities to be described and mapped in up to six levels, depending on the floristic and structural information available. Level 6 provides the greatest level of detail

The second dataset was the 1:100,000 scale 'Vegetation Mapping of the Daly River Catchment' (Cuff 2011). This dataset was found to be a good guide to where general boundaries were located and the types of vegetation that might be present, and was used in combination with the EcOz flora survey information. However, this dataset only extended for approximately 40 km of the first section of pipeline from Katherine and as such, its use was limited to this section.

The third dataset consisted of vegetation survey information extracted from the 'Resource Assessment Vegetation System' (DLRM 2013c), which is an oracle database containing individual survey and site information. The data contained a variety of attributes such as landform, flora species, some vegetation formation / community information etc. While occasionally interrogated, the majority of this site information was located outside of the mapped pipeline route.

The fourth main dataset was the NVIS - National Vegetation Information System, NT Data Compilation (DLRM 2000) which is a compilation of various mapping datasets from surveys undertaken throughout the NT. This dataset covered the entire proposed pipeline route, however the data was of a broad scale and as such, it was used as a broad guide to the vegetation types that might be present in a general area and where boundaries may occur.

A number of other datasets were utilised in the vegetation mapping process (Table 4-1).

Table 4-1: Datasets compiled and utilised during vegetation mapping of the KGGP pipeline

DATASET	SOURCE	SCALE	USE
World Imagery	ESRI (host) – multiple contributors (various dates)	Varies	Used as base image for aerial photograph interpretation (API) to identify patterns and signatures. Imagery quite poor at times with areas of cloud coverage, coarse scale, colour anomalies. Imagery interchanged with Bing Maps depending on dataset with best quality.
Orthographic aerial and satellite imagery	Microsoft Bing Maps (various dates)	Varies	Used as base image for API to identify patterns and signatures. Imagery quite poor at times with areas of cloud coverage, coarse scale, colour anomalies. Imagery interchanged with World Imagery depending on dataset with best quality.
Drainage	Bureau of Meteorology (2011)	1:250,000	Dataset helped in identifying drainage areas along with API.
Geology	Northern Territory Geological Survey (2011)	1:2,500,000	Very coarse dataset occasionally interrogated to see if change in geology may be signalling change in vegetation patterns.
Land systems	Department of Land Resource Management	1:250,000	Dataset used to help identify patterns in vegetation variations. Land

DATASET	SOURCE	SCALE	USE
	(2008)		systems boundaries helped assess if vegetation type boundaries would need to stop/start.
10 m contours	Gallant *et al.* (2011) Geoscience Australia	Derived from 30 m digital elevation model	Contours aided in delineating boundaries of various vegetation types that may have been affected by topology.
NVIS vegetation	Department of Land Resource Management (2000)	1:250,000	Broad guide only of vegetation boundaries and vegetation types in general areas.
Vegetation mapping of the Daly River catchment	Cuff (2011) Department of Land Resource Management	1:100,000	One of the finer scaled datasets of vegetation types. Heavy usage to help guide vegetation boundary delineation and classifications for roughly the first 40 km of pipeline from Katherine.
'Resource Assessment Vegetation System'	Department of Land Resource Management (2013c)	Survey site-specific	Detailed survey information, however most sites located outside mapping area. Occasionally examined along with aerial photography to see if information can be extrapolated to mapping areas.
EcOz flora survey sites	EcOz (2004)	Survey site-specific	Detailed survey information at approximately five kilometre intervals along pipeline. This data was the main information used to help guide vegetation classifications. As data was spot point information, API techniques were used to try and determine the patterns and signatures for recorded vegetation types.
ELA floristic site	ELA (2013)	Survey site-specific	12 detailed floristic spot point survey sites. Coverage was in the Mitchell Ranges and was used in later refinement of vegetation mapping in this area. Data used in combination with API techniques to identify patterns and signatures in imagery that may correspond to recorded vegetation types.
ELA vegetation descriptions	ELA (2013)	Survey site-specific	77 spot points containing vegetation descriptions. Coverage was in the Mitchell Ranges and was used in later refinement of vegetation mapping in

DATASET	SOURCE	SCALE	USE
			this area. Data used in combination with API techniques to identify patterns and signatures in imagery that may correspond to recorded vegetation types.

Desktop vegetation mapping

Digital desktop vegetation mapping and attribution was undertaken using Geographic Information Systems (GIS) software in ESRI ArcMap 10.0, nominally at a scale of 1:20,000 or better and using relevant available information. Given that only minor and indirect field based validation was available to inform the mapping, various limitations are recognised and discussed below.

Vegetation polygon boundaries were delineated through a process of aerial photograph interpretation (API) in combination with the interrogation of best available data such as site-specific survey data (floristic and vegetation type descriptions), contours, geology, land systems and existing broad scale vegetation mapping to assist identification of vegetation boundaries and assignment of a vegetation type.

An NVIS approach was taken to vegetation typing and generally, aimed to reach a Level 3 classification as a minimum. More detailed NVIS levels, such as Level 4, were not often achieved due to lack of sufficient site-specific information, however it was applied where available and appropriate. In areas of data deficiency, the identification of similar aerial patterns and signatures from polygons with higher confidence was used to extrapolate and assign classifications. A confidence level of the mapping and other attribution, such as presence of disturbance, was also applied to the digital layer. Broadly, the approach to vegetation type mapping utilised the following steps:

1. Establishment of the mapping study area and high level review of the characteristics of the supporting information across the study area.
2. Identification of vegetation patterns present in the aerial photography using API techniques.
3. Delineation of vegetation type linework following from step 2 and in consideration of supporting information such as field survey information, terrain (contours), soils/substrate, existing vegetation mapping and landscape context.
4. Attribution of vegetation polygon broadly using an NVIS approach and with ancillary information.
5. Extrapolation to other areas.
6. Systematic review and quality checking.

Desktop vegetation mapping limitations

Although mapping vegetation using API is one of the most recognised methods, there are inherent limitations with a vegetation layer that has been developed primarily through desktop techniques. These limitations include:

- The accuracy / resolution of the imagery. The two imagery datasets used as the basis for API contained no indication of currency, varied in resolution and exhibited colour variations depending on geographic location. Without knowledge of the date of the imagery, it was often difficult to assess whether the interpretation was suitable or even if vegetation as depicted in

the imagery still remained. In some areas, the resolution of the imagery meant that polygon boundaries representing extant vegetation could not be delineated or classification could not confidently be assigned. Colour variations between the images also confused the interpretation of patterns and signatures with the two image layers displaying varying base characteristics. In some cases areas of imagery were only available in grey tones.

- The ability to identify consistent colour signatures and patterns from aerial photography. Pattern interpretation carried out by a number of individuals can be a subjective process and may vary the outcome of line work creation and vegetation classification. However, a review of the line work and classifications, and subsequent adjustments were made by one person to minimise these variations.
- The ability to identify plant species from aerial photography. The mapping process was limited to recognising general patterns or signatures in the image. Without comprehensive or even targeted field data or first-hand local knowledge of the landscape, it is often difficult to objectively compare vegetation classification variations or to recognise specific plant species from the imagery alone. As a result most of the vegetation classifications were only able to be taken to the broad NVIS Level 3.
- Lack of comprehensive field data. The need for field data describing the floristic composition of a site is crucial for an effective mapping process. Field data provides a crucial guide to inform where broad boundaries between vegetation communities occur and explicitly provides a validated interpretation over an area. More comprehensive field data and validated polygons result in a greater level of confidence in the accuracy of boundary delineation and classification. This also enables a higher degree of extrapolation that can occur to surrounding polygons with no prior validation information. Flora surveys conducted in 2004 (EcOz 2004) provided the main source of data containing detailed floristic information that was available for most of the mapping area, however records were constrained to the immediate linear pathway of the proposed pipeline route. As a result, the data could only be extrapolated under circumstances when similar features could be identified in the landscape.

While the consequence of the limitations discussed is that the resulting vegetation layer has an overall low to medium confidence level in boundary delineation and attribution of vegetation classification, it is still a more detailed representation of vegetation types along the pipeline than has previously been available. As such, it enables a more adequate assessment of impacts that may occur. Confidence levels have also been assigned to individual vegetation polygons to inform likely accuracy.

4.1.3 Results

The mapped vegetation communities of the proposed pipeline corridor and a one kilometre buffer zone on either side is provided in Appendix C. A detailed digital copy can be obtained from the NT EPA.

4.2 VEGETATION AND FLORA – PREVIOUSLY UNSURVEYED AREAS

The Draft EIS described the existing vegetation communities, including listed threatened flora species, based on a fairly well-developed dataset from field surveys every five kilometres along the pipeline corridor and conducted during 2003-04. The exceptions were a 15 km segment between Annie Creek and the Goyder River (KP345-KP360) and a 36 km segment just north of the Mitchell Ranges (KP399-KP435), because the survey team was not able to access these portions of the project area. The Draft EIS therefore committed to completing surveys of these segments in the 2013 dry season. The rugged terrain and distance to access tracks however, rendered a survey of the

entire area within these two segments impossible. Therefore, information on the vegetation communities within these previously unsurveyed areas was obtained from a mixture of direct ground survey of accessible areas during 2013 and refinement of the digital desktop vegetation mapping layer. The ground surveys aimed to refine the draft vegetation map, producing a more detailed vegetation map for those segments.

In addition to developing a more complete and more up-to-date assessment of vegetation communities and threatened flora species based on new surveys and new data, the Draft EIS also committed to recording and describing any major weed infestations encountered during the 2013 field surveys. This information is also presented in this section for the areas surveyed.

4.2.1 Unsurveyed area to the north of the Mitchell Ranges (KP396-KP435)

Introduction

Vegetation community information was collected in the field from accessible areas of the unsurveyed section to the north of the Mitchell Ranges. Survey sites required approval by the Aboriginal traditional owners prior to the field effort and a rigorous pre-selection process was set in place (see below for criteria) to ensure the sites targeted were representative and ecologically significant habitats.

Methods

Selection of survey sites

A pre-field survey assessment of the unsurveyed section (KP399-435) was conducted using satellite imagery, topographic maps and the vegetation map to identify the general landscapes and vegetation communities of the area and potential habitats for ecologically significant species such as riparian habitats, rainforest and sandstone vegetation. Survey target areas were identified based on the following criteria:

- Potential habitats for ecologically significant species within the proposed ROW such as
  - sandstone heathlands (including the EPBC Act listed Threatened Ecological Community: Arnhem Plateau Sandstone Shrubland Complex);
  - riparian forests and wetlands (mainly identified as *Melaleuca* woodlands in the draft vegetation map); and
  - all major creek/river crossings within the proposed pipeline ROW.
- Unusual vegetation types, such as a *Chrysopogon* grassland, identified in the draft vegetation map.
- All major vegetation community types of the draft vegetation map to validate the mapping.
- Unclassified areas and areas with low confidence in data used in the draft vegetation map, to gain better mapping confidence.

Through this process, 12 sites in the segment north of the Mitchell Ranges were pre-selected (and approved by the Aboriginal traditional owners) for the May 2013 survey.

At the time of preparing the Draft EIS, the only threatened flora identified in close proximity to the ROW was *Pternandra coerulescens* which was known to occur within 750 m of the pipeline in riparian forest along the Latram River (outside of the unsurveyed area). Therefore, no sites for intensive floristic threatened species searches were identified in the unsurveyed area north of the Mitchell Ranges.

Vegetation community ground surveys

The botanical ground surveys were undertaken by experienced botanists familiar with NT flora, in early May 2013. The timing of the surveys, from an ecological point of view, was ideal. At this time of the year, the vegetation is green; smaller herbs and ferns are still present in the understorey; and the land is largely unburnt, while unsealed roads are trafficable again (post-inundation from the wet season).

Addressing access constraints, survey objectives and the above site selection criteria, 12 detailed vegetation community surveys and 77 additional vegetation descriptions were conducted to support the detailed vegetation mapping (Figures 4-1 to 4-4). The vegetation community surveys followed the 'NT Guidelines and Field Methodology for Vegetation Survey Mapping' (Brocklehurst *et al*. 2007), which are in line with the National Vegetation Information System NVIS (DSEWPaC 2013) and the 'Australian Vegetation Survey Guidelines' (Hnatiuk *et al*. 2009). These are nationally recognised standards for surveying, classifying and mapping vegetation communities. The standard allows for vegetation communities to be described and mapped in up to six levels, depending on the floristic and structural information available. Level 6 provides the greatest level of detail.

The detailed surveys recorded all plant species, their height and percentage cover within 20 m x 20 m quadrats. Also recorded were the average heights and percentage covers for each stratum (upper, mid and ground-storeys) and the average composition of the ground cover (percentage bare ground, litter, vegetation, crust, exposed rock and gravel). Photos were taken of every site. The basal area of the quadrat and the surrounding vegetation community was recorded with a Bitterlich wedge. Based on this method, each site was described and classified at NVIS Level 5. The additional vegetation community descriptions were commonly classified up to NVIS vegetation Level 4-5.

The 12 detailed surveys targeted the major vegetation communities and provided additional and more detailed information for the vegetation map categories. The additional 77 vegetation descriptions targeted changes in vegetation, special vegetation features and other landscape features (e.g. creek lines). Both surveys provided more detailed and validated information that were used to refine vegetation boundaries and attribution of classifications within the digital desktop vegetation layer.

Detailed vegetation community mapping

The digital desktop vegetation mapping layer for the proposed pipeline route and access tracks (methodology outlined in section 4.1.2) was used as the base for further refinements following field validation.

At each field validation point, the underlying aerial photography was examined to determine a signature or pattern for the validated vegetation type. Boundaries were realigned and attribution of polygons adjusted where the corresponding field validated information suggested differences to the draft mapping. These areas of higher confidence were then extrapolated to areas of lower confidence (which often had no validation points available) based on the identification of similarities in vegetation patterns displayed in the imagery.

While 12 detailed surveys classified NVIS levels down to Level 5, this information could only be extrapolated to nearby polygons with a degree of confidence due to the changing nature of the landscape. As a result of data deficiencies for the remaining areas, the digital dataset mainly achieves an NVIS classification of Level 3. The polygons nearby to the 12 detailed surveys and 77 additional vegetation descriptions are generally of a higher confidence than those located further away or in changing landscapes.

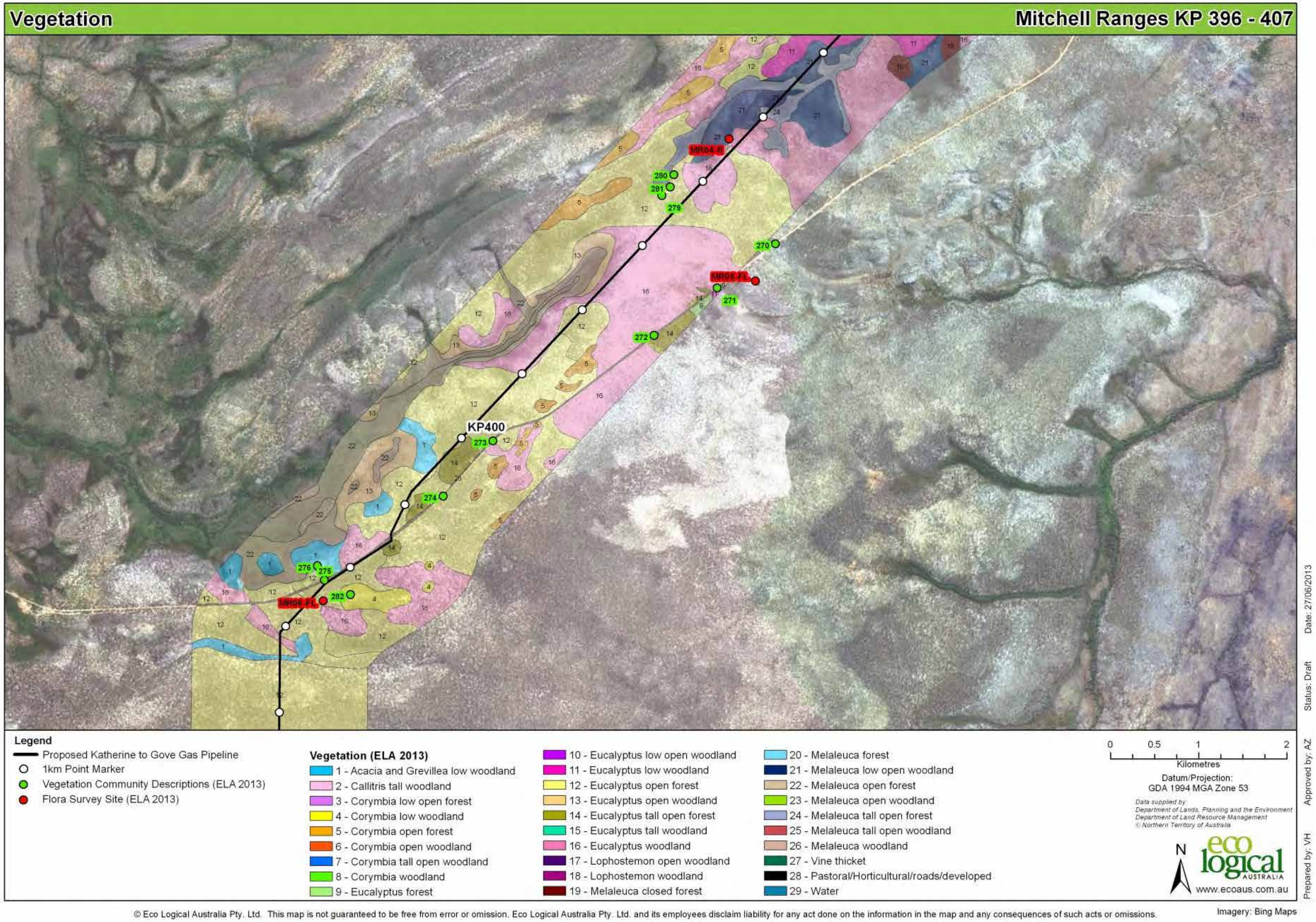


Figure 4-1: Detailed vegetation community surveys and vegetation descriptions KP396-KP407

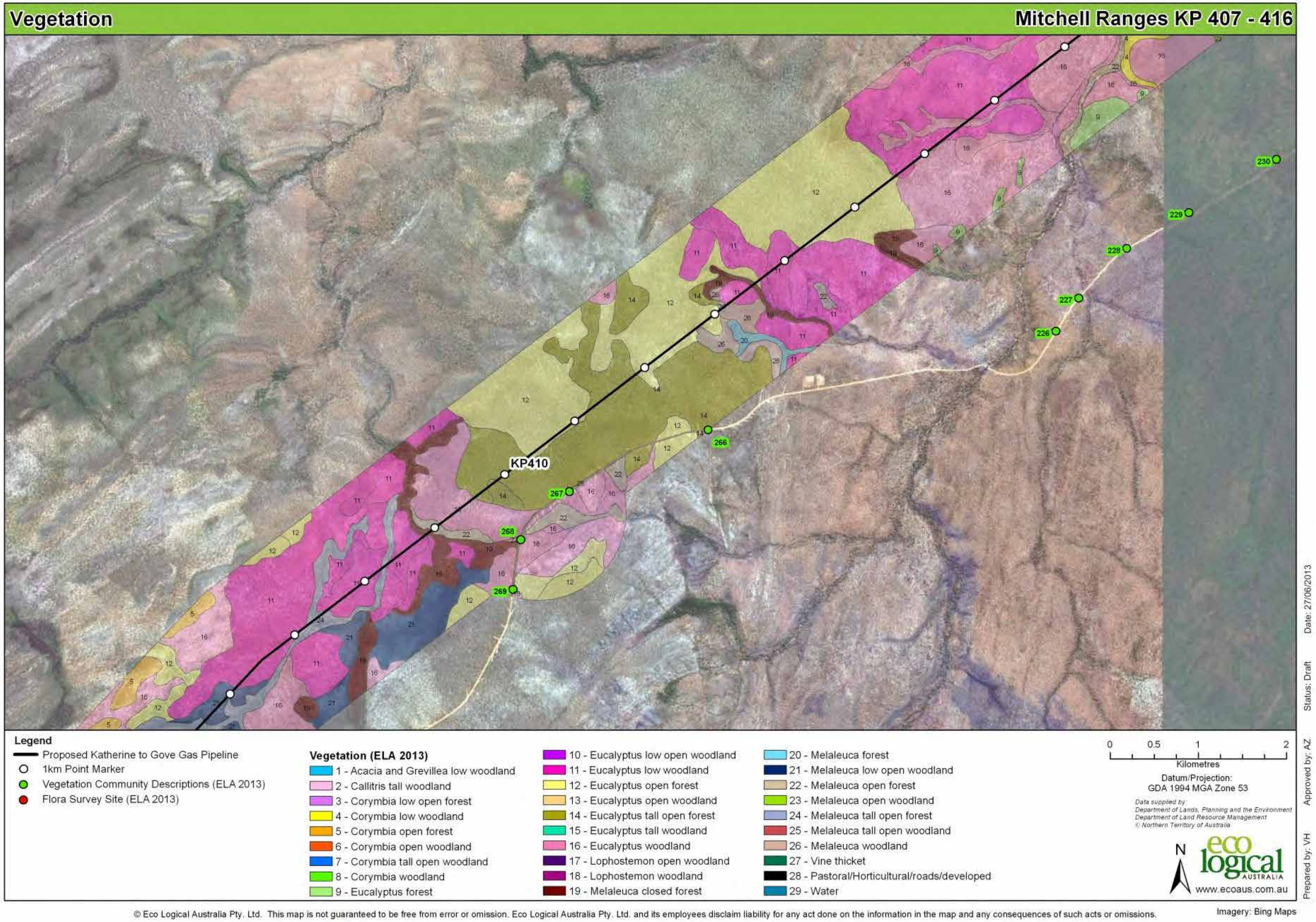


Figure 4-2: Detailed vegetation community surveys and vegetation descriptions KP407-KP416

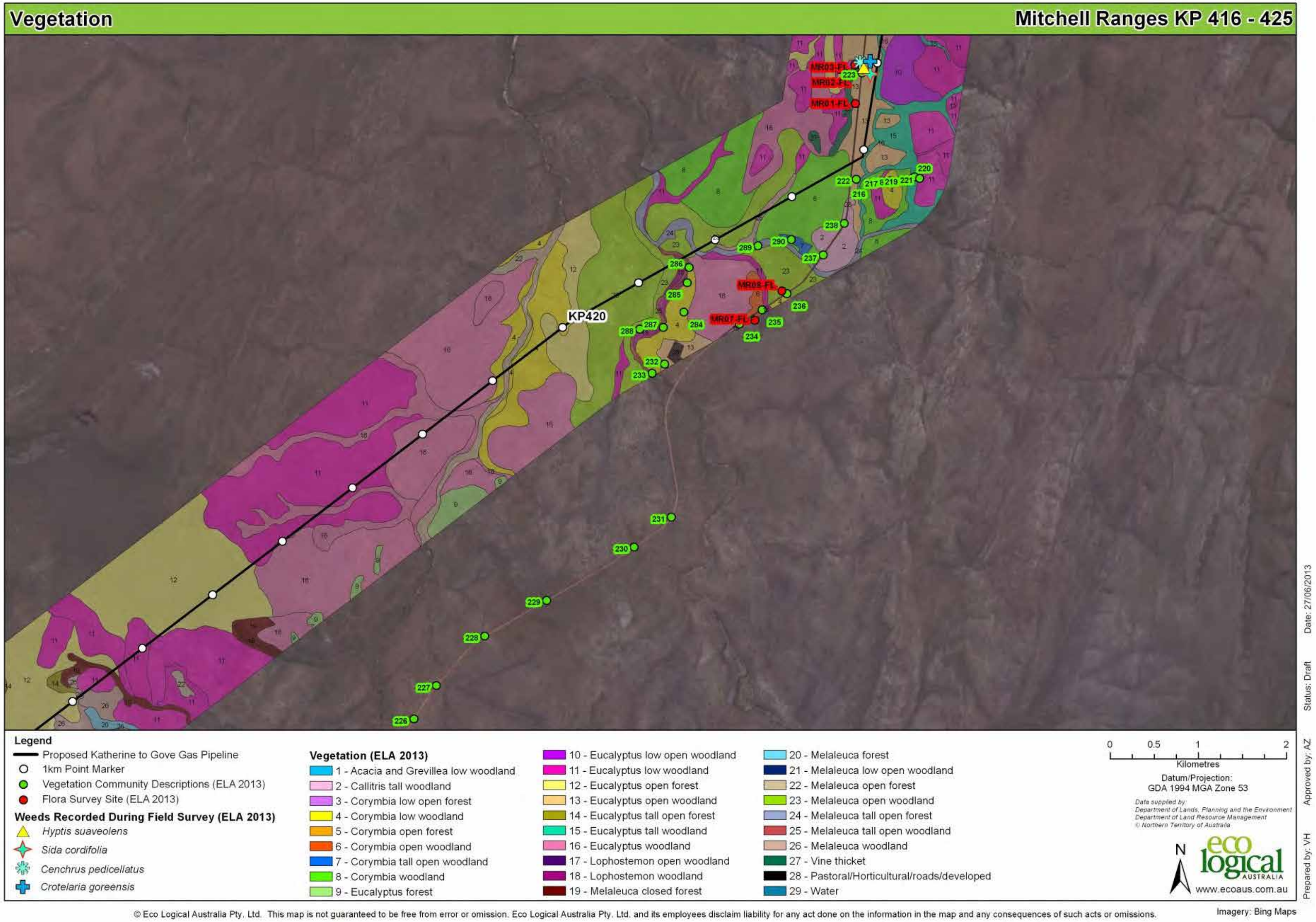


Figure 4-3: Detailed vegetation community surveys and vegetation descriptions KP416-KP25

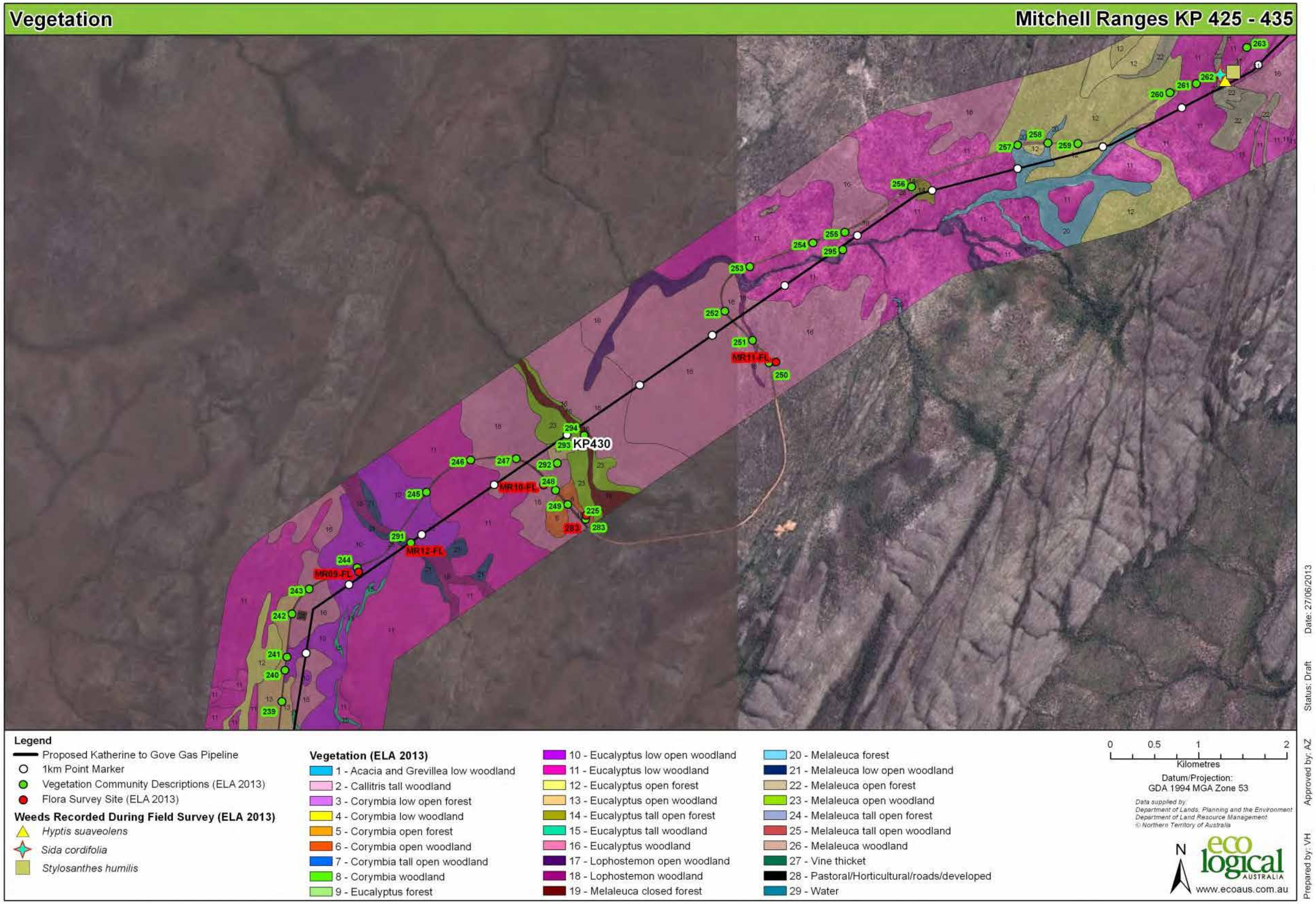


Figure 4-4: Detailed vegetation community surveys and vegetation descriptions KP425-KP435

4.2.2 Results

The unsurveyed segment north of the Mitchell Ranges is described in the 'Land Systems of Arnhem Land' (Lynch and Wilson 1998) as 'elevated rocky plateau and rolling to steep hills dominated by open woodland of *Eucalyptus tetrodonta, E. miniata, E. phoenicea* and *Callitris intratropica'*. This description is largely reflected by the results of the ground surveys, which targeted sites representative of the major vegetation communities of the segment north of the Mitchell Ranges. A NVIS Level 5 description of the vegetation communities of these sites is presented in Table 4-2.

Table 4-2: NVIS Level 5 classification summaries of the vegetation communities recorded in the north of the Mitchell Ranges segment.

VEGETATION COMMUNITY SITE	UPPER-STOREY	MID-STOREY	GROUND-STOREY
MR001-FL (close to pipeline)	*Eucalyptus bigalerita* mid open woodland	*Cullen badocanum* sparse shrubland	*Heteropogon triticeum* mid grassland
MR002-FL	*Eucalyptus tetrodonta, Corymbia ferruginea* mid open forest	*Grevillea heliosperma* low open woodland	*Erythrophleum chlorostachys*, *Petalostigma quadriloculare* low shrubland
MR003-FL	Vine thicket		
MR004-FL (close to pipeline)	*Melaleuca nervosa, Grevillea pteridifolia* low open woodland	Isolated *Banksia dentata* and *Verticordia cunninghamii* trees	*Leptocarpus spathaceus* mid forbland
MR005-FL	*Eucalyptus phoenicea, Corymbia bleeseri, Eucalyptus tetrodonta* low woodland	Isolated trees of *Eucalytpus phoenicea*	*Triodia microstachys* open hummock grassland
MR006-FL (close to pipeline)	*Eucalyptus tetrodonta, Corymbia bleeseri* mid open forest		*Triodia microstachya, Alloteropsis semialata* and forbs sparse hummockgrassland
MR007-FL	*Corymbia latifolia, Eucalyptus tetrodonta* mid open woodland	*Erythrophleum chlorostachys, Grevillea decurrens* open woodland	*Petalostigma quadriloculare, Schizachyrium fragile, Spermacoce elaiosoma* forbland
MR008-FL	*Corymbia polycarpa, Melaleuca viridiflora* mid open woodland	Isolated shrubs of *Acacia latescense, Acacia difficilis, Grevillea pteridifolia*	*Leptocarpus spathaceus, Sorghum intrans, Eriachne triseta* open forbland
MR009-FL (close to pipeline)	*Eucalyptus jensenii, Eucalyptus tetrodonta* low open woodland	Isolated shrubs of *Hibbertia candicans*	Mixed *Hibbertia angustifolia, Hibbertia complananta, Schizachyrium fragile* forbland
MR0010-FL	*Eucalyptus tetrodonta,*	*Acacia oncinocarpa,*	*Sorghum plumosum,*

VEGETATION COMMUNITY SITE	UPPER-STOREY	MID-STOREY	GROUND-STOREY
	Eucalyptus miniata mid woodland	*Erythrophleum chlorostachys* sparse shrubland	*Sorghum intrans, Alloterosis semialata* low grassland
MR0011-FL	*Eucalyptus jacobsiana, Eucalyptus tetrodonta, Callitris intratropica* mid woodland	Isolated trees of *Brachychiton megaphyllus*	*Sorghum intrans, Heteropogon triticeus* low open grassland
MR0012-FL (close to pipeline)	*Lophostemon lactufluus, Pandanus spiralis, Melaleuca viridiflora* mid woodland	*Acacia leptocarpa* low open shrubland	*Bothriochloa bladhii, Germania truncatiglumis* mid grassland

As indicated in Table 4-2, and Figures 4-1 to 4-4, flora survey sites MR001-FL, MR004-FL, MR006-FL, MR009-FL and MR0012-FL as well as seven of the site descriptions were on or closely located to the proposed pipeline. Photos of some of these sites are provided in Figures 4-5 and 4-6.

Figure 4-5: Vegetation community at sites MR0001-FL and MR0004-FL

Figure 4-6: Vegetation communities at sites MR0006-FL and MR0009-FL

Through desktop mapping techniques and the incorporation of survey data into the vegetation mapping layer, 27 vegetation communities were identified for the vegetation community map of the segment north of the Mitchell Ranges (Figures 4-1 to 4-4).

Potential habitats for ecologically significant species could be encountered in the vegetation communities mapped as:

- *Acacia* and *Grevillea* low woodland, south of KP400. During the 2013 survey a vegetation community description (276) identified the area as *Acacia torulosa, Grevillea pteridifolia* low isolated trees with *Eriachne triseta*, *Alloteropsis semialata* and *Melaleuca nervosum* grassland ground storey. *Acacia torulosa* is common in sandstone escarpment country and generally dry and often sandy habitats. The species also occurs beside streams in deep sand, which is the more typical habitat for *Grevillea pteridifolia*. No other sandstone escarpment species were identified.
- *Eucalyptus* low open woodland, close to KP427. A full floristic survey of this vegetation community (MR009-FL) identified it as *Eucalyptus jensenii, Eucalyptus tetrodonta* low open woodland with isolated shrubs of *Hibbertia candicans* in the mid storey *and* mixed *Hibbertia angustifolia, Hibbertia complananta, Schizachyrium fragile* forbland groundstorey. The dominant tree species, *Eucalyptus jensii*, can be found on open hills and rocky ridges. Also represented in this community were open woodlands of *Eucalyptus tetrodonta*, *E. tectifica*, *E bigalerita*, *Erythrophleum chlorostachyus* and or *Corymbia latifolia* (vegetation community descriptions 240, 241, 244).
- Containing *Melaleuca* and *Lophostemon* species. These are commonly associated with wetter habitats and were frequently mapped and encountered during the ground surveys (e.g. MR00-4-FL, MR0012-FL) and river crossings.
- The ‘unusual’ vegetation type classified as Chrysopogon grassland on the draft vegetation map. This was identified as a *Melaleuca nervosa, Grevillea pteridifolia* low open woodland with isolated Banksia dentata and *Verticordia cunninghamii* trees in the mid story and a *Leptocarpus spathaceus* mid forbland in the ground storey (see site MR004-FL, Table 4-2).

No species listed as threatened under the EPBC Act or the TPWC Act were encountered during the ground surveys. All of the vegetation communities mapped (at 1:20,000) within the proposed pipeline ROW are well represented within the region one kilometre either side of the pipeline (Figures 4-1 to 4-4).

All weeds encountered during the ground survey were recorded following the methods outlined in the ‘NT Guidelines and Field Methodology for Vegetation Survey and Mapping’ (Brocklehurst et al. 2007). This included estimations of the diameter and density of the weed populations and records of soil and vegetation disturbances.

Weed infestations were observed at two sites, of which both were located near the Central Arnhem Road (Figure 4-7). The species and scope of weed infestations are detailed in Table 4-3. Both sites showed signs of soil and vegetation disturbance.

Table 4-3: Weed infestations encountered during the 2013 floristic survey of the segment north of the Mitchell Ranges

SITE	WEED SPECIES	COMMON NAME	DIAMETER CATEGORY	DENSITY CATEGORY
1	*Hyptis suaveolens*	Hyptis	21 - 50 m	>50 %
1	*Sida cordifolia*	Flannel weed	21 – 50 m	>1 – 10 %
1	*Crotelaria goreensis*	Gambia pea	21 - 50 m	<1 %
1	*Cenchrus pedicellatus*	Annual mission grass	0 - 5 m	>1 – 10 %
2	*Sida cordifolia*	Flannel weed	6 - 20 m	>1 – 10 %
2	*Hyptis suaveolens*	Hyptis	6 - 20 m	< 1 %
2	*Stylosanthes humilis*	Townsville stylo	6 - 20 m	> 1 – 10 %

Of the five weed species recorded two are declared weeds: Hyptis (*Hyptis suaveolens*); and Flannel Weed (*Sida cordifolia*), both listed as B/C (growth and spread to be controlled/ not to be introduced to the Territory) under the *Weeds Management Act*. Annual mission grass (*Cenchrus pedicellatus*) was only a minor component of one of the recorded weed infestations, but with fluffy seeds dispersed by wind, it has the greatest potential to spread throughout the region.

4.2.3 Unsurveyed segment Annie Creek to Goyder River (KP345-KP360)

The 15 km segment between Annie Creek and Goyder River (KP345-360) was not surveyed in the field, as the section is small enough to extrapolate information from the adjacent 2004 field survey sites (EcOz 2014). The vegetation communities of this small section were determined following the methods outlined in section 4.1.2.

The mapping analysis identified 12 vegetation communities within the region one kilometre either side of the proposed pipeline ROW in the Annie Creek Tributary to Goyder River segment (approximately KP345-KP360) (Figures 4-8 and 4-9). The vegetation communities identified through mapping range from tussock grassland (north-west of the segment) to *Eucalyptus* open forests. The dominant vegetation community is *Eucalyptus* woodland. A small area identified as 'sparse shrubland' about 500 m south of KP349 could be a potential habitat for ecologically significant species.

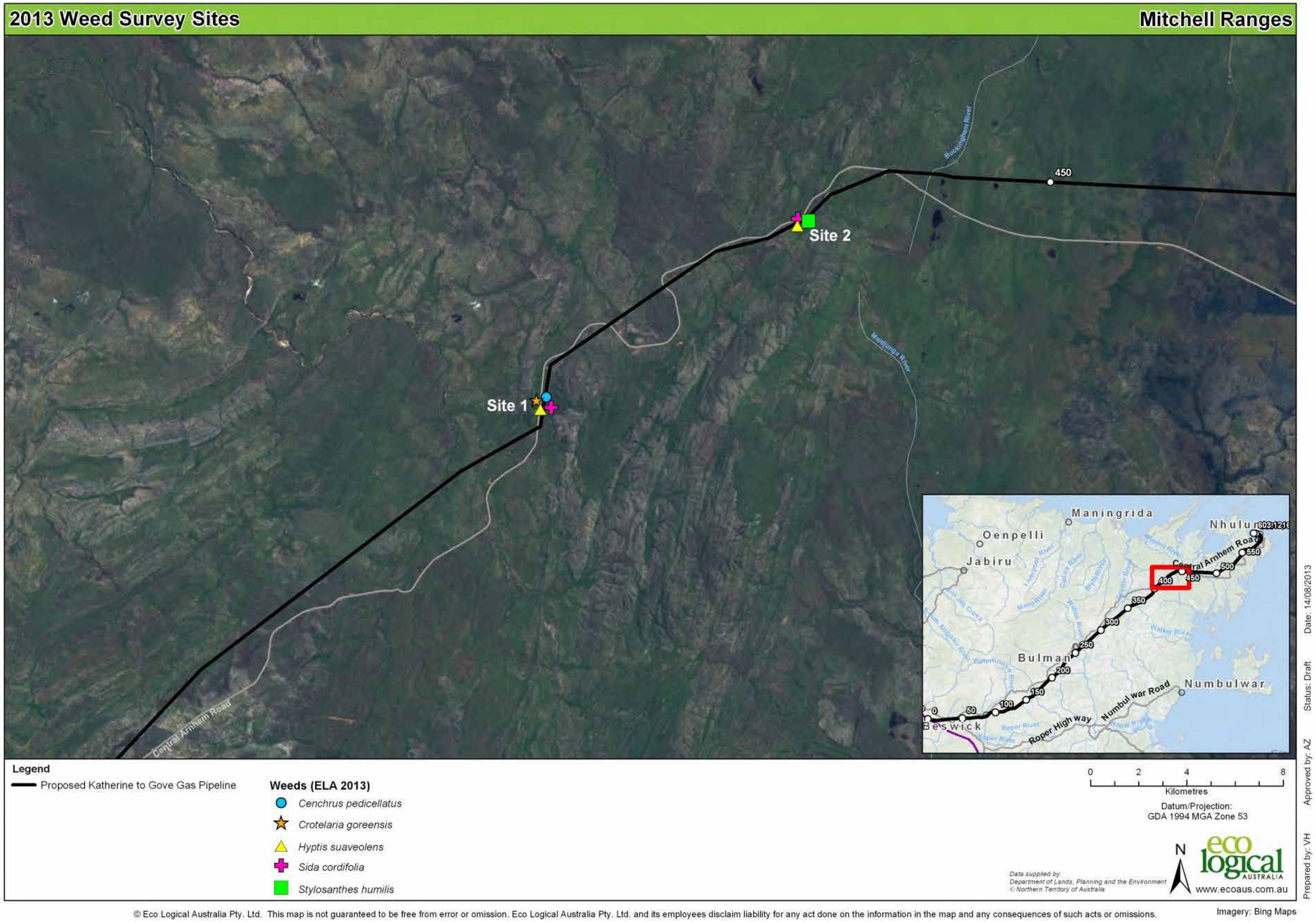


Figure 4-7: Location of weeds recorded during the 2013 flora survey of the area to the north of Mitchell Ranges

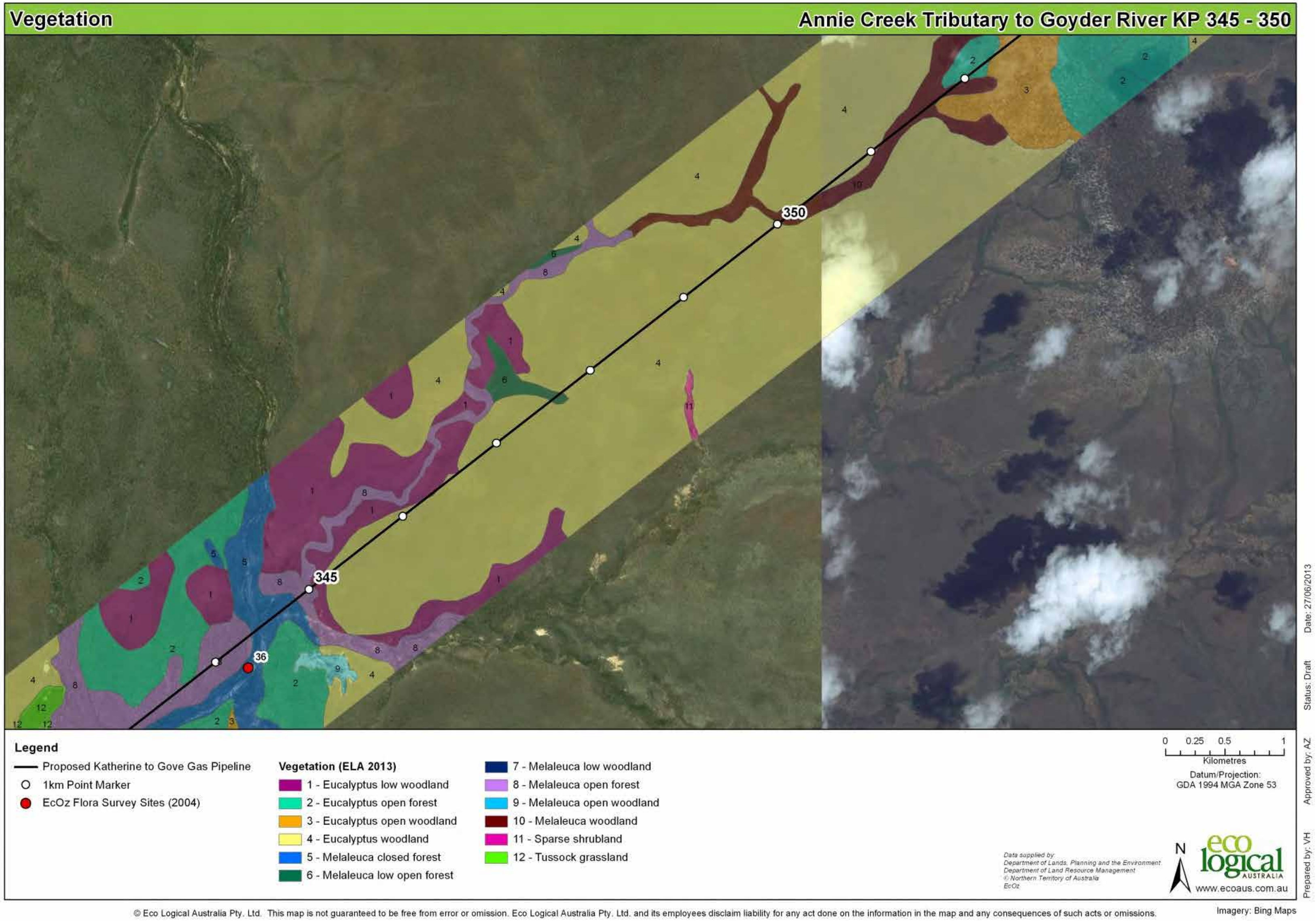


Figure 4-8: Vegetation map for Annie Creek tributary to Goyder River KP345-KP350

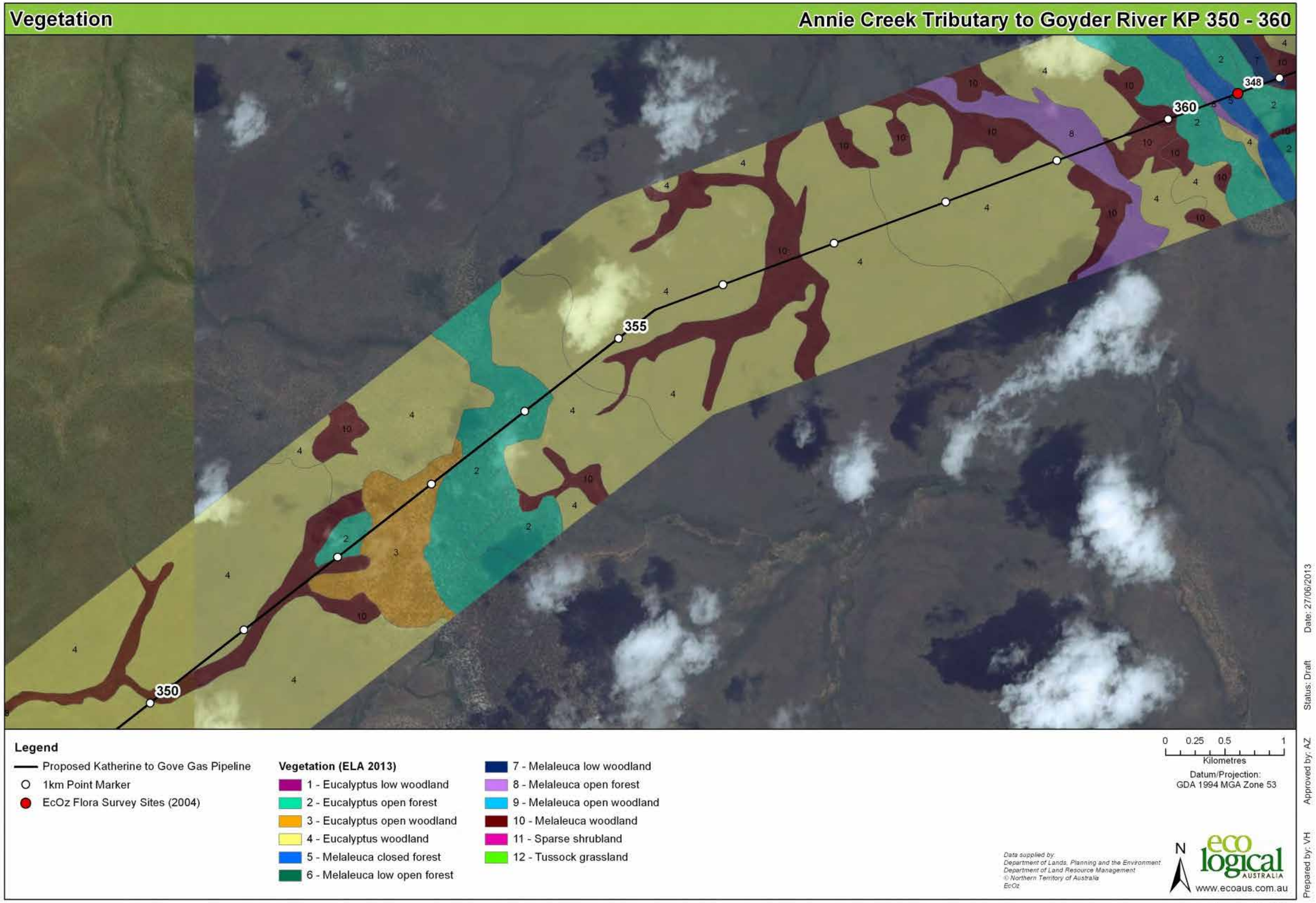


Figure 4-9: Vegetation map Annie Creek tributary to Goyder River KP350-KP360

4.3 TARGETED SURVEY FOR *PTERNANDRA COERULESCENS*

Introduction

Pternandra coerulescens (Vulnerable under the TPWC Act; not listed under the EPBC Act) is a small tree or shrub occurring in spring-fed rainforests and riparian forests and has been recorded from the Latram River, the Giddy River (and two of its tributaries), and tributaries of the Cato River. Historical records were known to be within 750 m of the pipeline centreline, but were not recorded during the 2004 flora survey (Figure 4-10). Since it was not known if the species had re-colonised the area surveyed in 2004, or spread closer to the pipeline corridor in the nine years since, targeted searches were conducted in the area around the known historical record (the riparian forests of the Latram River). The relevant section of the Giddy River within the proposed pipeline corridor was also surveyed at a location near where the river crossed the Central Arnhem Road.

Methods

On 14 May 2013, two botanists and two rangers from the Dhimurru Indigenous Protected Area (IPA) undertook the survey to determine if the current distribution of the species overlapped the proposed pipeline corridor. The survey started at the camping area at the Latram River and involved walking approximately 1.5 km along the eastern bank of the river through the riparian zone. The locations of individual plants or groups of plants were recorded using GPS equipment (providing latitude and longitude readings). In addition, the height of the tallest plant was recorded. This distribution and abundance information was required for assessing potential project impacts and will be useful for any future monitoring program. The survey covered at least 80% of the targeted area in addition to potential habitats in the immediate surroundings.

Results

Dhimurru rangers spotted the species almost immediately at the start point of the survey and from then onwards individuals and populations of this species were recorded frequently (Figure 4-11). Some plants were noted on the opposite (western) bank. *Pternandra* were most often found where the rainforest vegetation was thick. Where the vegetation thinned, individuals seemed to grow out of the bank at the edge of the water, and at times were partially submerged.

In most cases, the species was found in clusters of plants, generally spread over no more than 15 m, with most groups in patches of 10 m or less.

No signs of recent fire were noted (i.e. burned leaves or branches etc.) but very few plants were found in areas close to the river which had been affected by fire in previous years. The impact of fire on this species is largely unknown and should be recorded were possible to provide useful information for future management.

No *Pternandra* were recorded in the surveyed areas of the Giddy River.

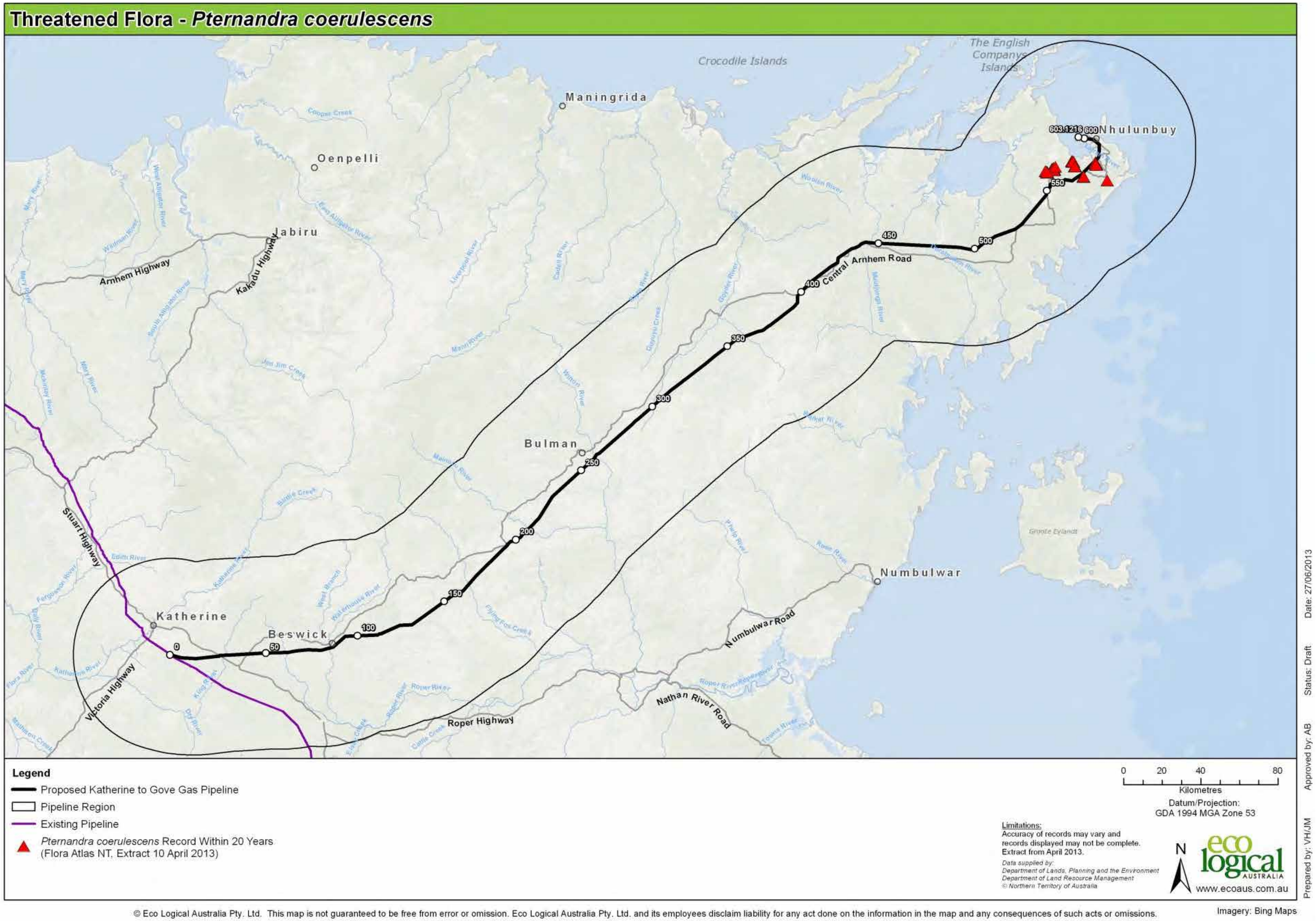


Figure 4-10: Historical records of threatened flora species *Pternandra coerulescens*

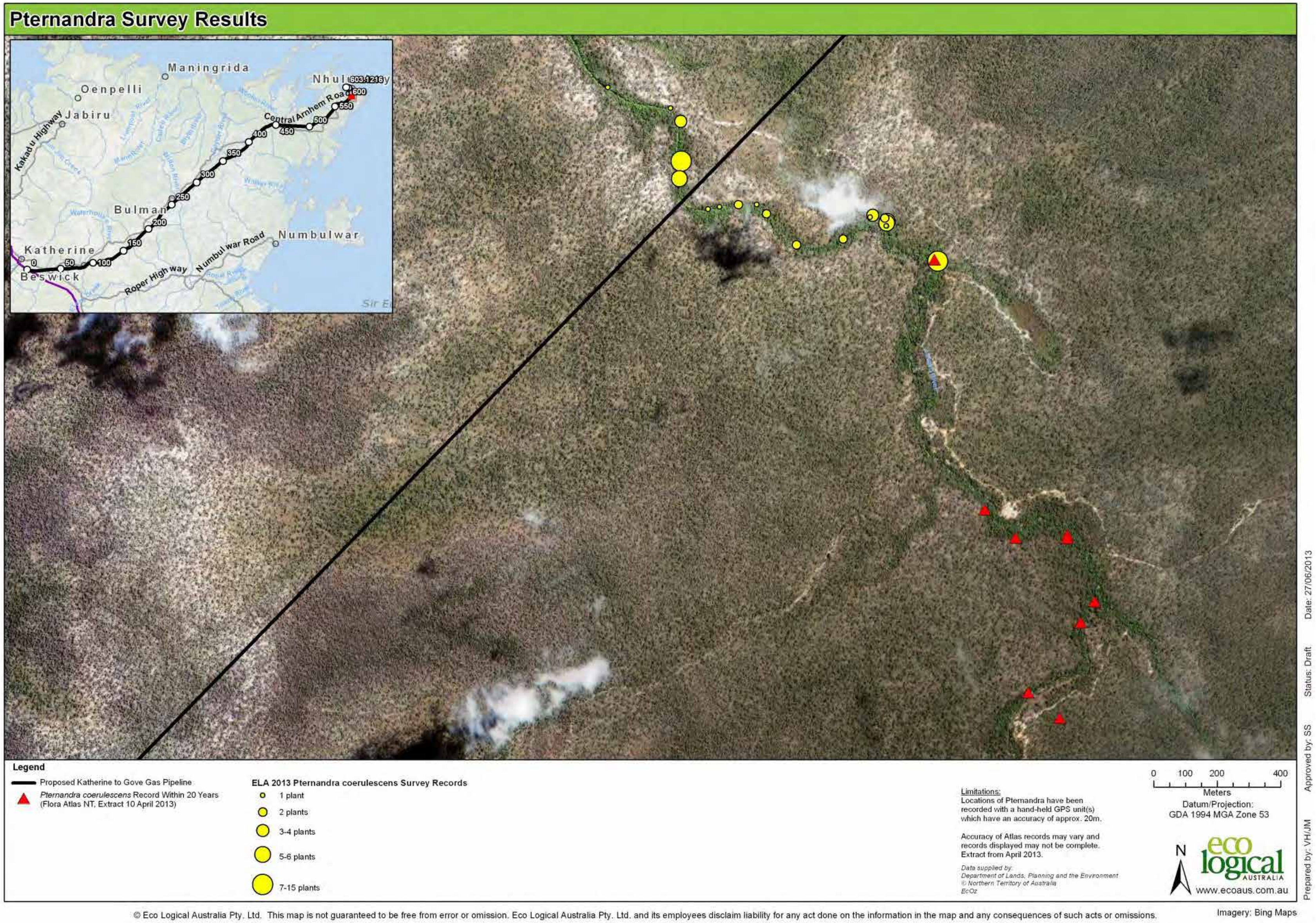


Figure 4-11: Survey records of *Pternandra coerulescens* at the Latram River site

4.4 TERRESTRIAL FAUNA – UNSURVEYED AREA NORTH OF THE MITCHELL RANGES

4.4.1 Introduction and background

The previously unsurveyed area (Figure 4-12) is of particular importance because the pipeline corridor is proposed to traverse to the north of the Mitchell Ranges. Although the corridor does not cross the Mitchell Ranges itself, sandstone outcrops occur in the area which may constitute habitat for a suite of species not found elsewhere along the pipeline corridor. Species unique to this landform and region may require specific management.

Permission to access the previously unsurveyed area was granted by the Aboriginal traditional owners in early 2013. A targeted fauna survey was conducted over five days and nights with participation of a senior Aboriginal traditional owner and the Gurrwiling Indigenous Rangers. The survey aimed to determine the species known or likely to occur (particularly within landforms unique to this section of the pipeline route) and build upon existing fauna data sets collected along the remainder of the pipeline corridor during the 2004 and 2012 surveys and reported in the Draft EIS. The survey was undertaken in the early dry season of 2013 and comprised:

- Elliott and funnel trapping.
- Remote infra-red cameras.
- Bird census surveys.
- Call broadcast survey for the Northern Crested Shrike-tit.
- Nocturnal spotlighting.
- Opportunistic sightings of fauna made while traversing the area.

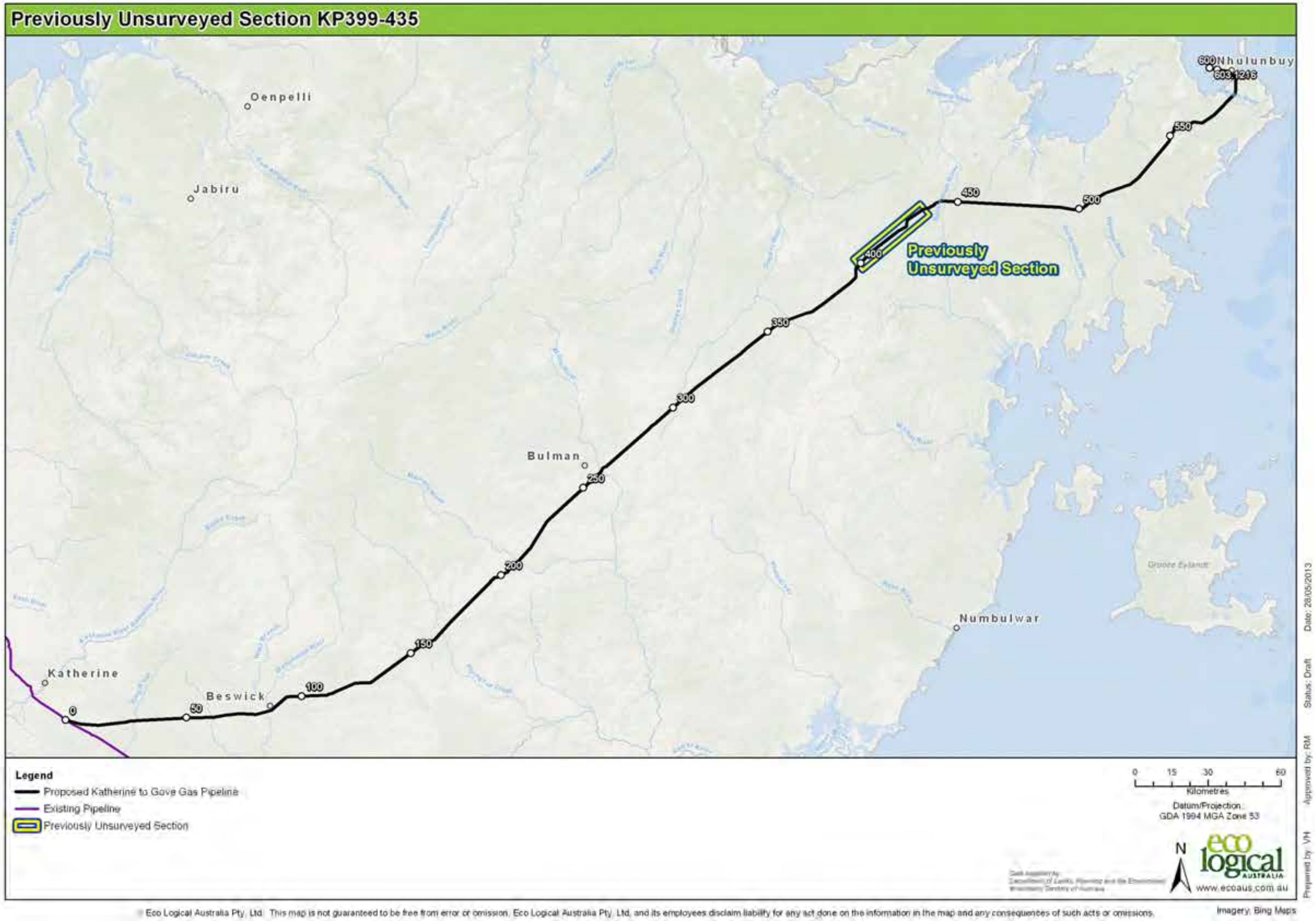


Figure 4-12: Location of the KGGP and the previously unsurveyed section to the north of the Mitchell Ranges

4.4.2 Methods

Desktop review

A review of the available literature and records pertaining to the fauna along the entire pipeline corridor was conducted during preparation of the KGGP Draft EIS (sections 9.1.1 and 10.3). The results of that analysis were refined to address the previously unsurveyed section.

Target species

Nineteen potential target species in the unsurveyed area were identified through the DSEWPaC Protected Matters Search Tool (including a 10 km buffer around the pipeline route, Table 4-4). The likelihood of each of these species occurring in the previously unsurveyed area was refined from the assessment of likelihood conducted for the entire pipeline for the Draft EIS (section 10.3). Target species for the 2013 dry season survey were those considered likely to occur within the unsurveyed area, and which may be impacted by construction or operation of the KGGP (Table 4-5).

Selection of survey sites

The selection of survey site was a three-step process. Firstly, a desktop review of digital vegetation mapping conducted by Eco Logical Australia (section 4.1 and Appendix **C** of EIS Supplement) was used to stratify the site. Secondly, field reconnaissance was undertaken to select sites, with a preference for habitat unique to the area (such as rock outcrops), riparian areas (typically species rich sites), or potential threatened species habitat. Thirdly, discussions with Aboriginal traditional owners were undertaken during both the desktop and site reconnaissance stage to avoid culturally sensitive areas.

Field survey methodology

The survey was carried out over five days between 9 and 13 May 2013. Fauna surveys were undertaken by ELA ecologists Dr Sarah Smith, Bruce Mullins, Belinda Failes, Ryan Smithers and Ranid May. Surveys were conducted under a Northern Territory Parks and Wildlife Commission ‘Permit to take wildlife for commercial purposes’ number 46062 (amended 8 May 2013). Access to the survey area was granted by the Aboriginal traditional owners and the Northern Land Council (NLC) under permit number 42480.

Habitat types surveyed

Three habitat types were surveyed at four survey sites: outcropping rock and adjacent woodland (two sites); riparian corridor (one site); and woodland adjacent to riparian corridor (one site).

Table 4-4: EPBC Act listed threatened and migratory species identified through the protected matters search and their likelihood of occurrence in or near the KGGP ROW

SPECIES	CONSERVATION STATUS	LIKELIHOOD* OF OCCURRENCE IN THE SURVEY AREA
Birds		
Barn Swallow (*Hirundo rustica*)	EPBC migratory	**Unlikely.** The species has a wide recorded distribution across northern Australia and prefers open country in coastal lowlands (usually near towns or cities), and freshwater wetlands, paperbark *Melaleuca* woodland, mesophyll shrub thickets and tussock grassland. Suitable habitat is unlikely to occur in the unsurveyed area.
Cattle Egret (*Ardea ibis*)	EPBC migratory	**Likely.** This species is a relatively small egret found in grasslands, woodlands and wetlands. The Cattle Egret is considered to be widespread and common. Breeding colonies have been observed in Arnhem Land.
Eastern Great Egret (*Ardea modesta*)	EPBC migratory	**Possible.** This species is widely distributed in Australia and is known to occur in habitat including wetlands, flooded pastures, dams, estuarine mudflats, mangroves and reefs. This species may utilise the site however habitat present is not considered to be important to the survival of the species.
Fork-tailed Swift (*Apus pacificus*)	EPBC migratory	**Possible.** The project area traverses three regionally significant wetlands and six other regionally significant wetlands occur in the vicinity. This species favours shallow, open, freshwater wetlands and swamps. While this species does not breed locally, and the site is not considered to be an area of important habitat for this species, it may fly over the pipeline corridor.
Gouldian Finch (*Erythrura gouldiae*)	EPBC endangered and migratory NT vulnerable	**Unlikely.** Suitable habitat for this species is present between approximately KP0 and KP120 in the form of a range of annual and perennial grasses in lowlands, rocky hills with suitable smooth stem salmon gums (for breeding), and small pools that persist through the dry season. Potential suitable habitat also occurs in isolated patches in the central portion of the pipeline corridor but is unlikely to occur in the unsurveyed area.
Melville Cicadabird (*Coracina tenuirostris melvillensis*)	EPBC migratory	**Possible.** The Melville Cicadabird occurs in northern Australia from Broome in WA to the far eastern Top End of the NT. This species prefers diverse forests and woodlands, including mangroves and paperbark swamps.

SPECIES	CONSERVATION STATUS	LIKELIHOOD* OF OCCURRENCE IN THE SURVEY AREA
Northern Crested Shrike-tit (*Falcunculus frontatus whitei*)	EPBC vulnerable and migratory	**Likely.** Preferred habitat for the Northern Crested Shrike-tit occurs across the project area as woodlands, in particular *Eucalyptus tectifica* and *Corymbia latifolia* woodlands.
Northern Masked Owl (*Tyto novaehollandiae kimberli*)	EPBC vulnerable NT vulnerable	**Possible**. Preferred habitat consists of riverine forest, rainforest, open forest, paperbark swamp and the edge of mangroves. Some habitat present along corridor but unlikely to occur in the unsurveyed section.
Rainbow Bee-eater (*Merops ornatus*)	EPBC migratory	**Likely.** This species is distributed across much of inland Australia and occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. In northern Australia it often inhabits mangroves (DSEWPaC, 2013e).
Red Goshawk (*Erythrotriorchis radiatus*)	EPBC vulnerable NT vulnerable	**Likely**. Several records of this species in NT Fauna Atlas in proximity to pipeline route. In the NT the Red Goshawk prefers tall open forest and woodland or tall fringing woodlands along rivers in grassland, shrub-lands, and low open woodlands.
Rufous Fantail (*Rhipidura rufifrons*)	EPBC migratory	**Likely.** This species was recorded in the north-east of the pipeline route. The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia and is a common and secure species. Significant impacts to this species are unlikely.
White Bellied Sea-eagle (*Haliaeetus leucogaster*)	EPBC migratory	**Possible.** This species was recorded in the north-east of the pipeline route. This species is widely distributed.
Insects		
Gove Crow Butterfly (*Euploea alcathoe enastri*)	EPBC endangered	**Highly unlikely**. Pipeline route has been designed to avoid habitat for this species. Prefers patches in the transitional zone (ecotone) between evergreen monsoon vine-forest and eucalypt / paperbark woodland associated with permanent creeks or swamps. The species has not been recorded as far south as the unsurveyed section.
Mammals		
Bare-rumped Sheath-tailed Bat (*Saccolaimus saccolaimus nudicluniatus*)	EPBC critically endangered	**Unlikely**. Pipeline lies well south of few records of this species in the Northern Territory. There are no recent records from the Top End of the Northern Territory to even indicate whether the species still occurs in this region.

SPECIES	CONSERVATION STATUS	LIKELIHOOD* OF OCCURRENCE IN THE SURVEY AREA
Brush-tailed Tree-rat (*Conilurus penicillatus*)	EPBC vulnerable NT endangered	**Possible**. The pipeline corridor is located well south of the primary distribution of this species. However the NT Fauna Atlas shows some records further south towards the pipeline corridor. The Brush-tailed Rabbit-rat occurs in eucalypt tall open forest and coastal grasslands and shelters in tree hollows, hollow logs and occasionally in the crowns of pandanus or sand-palms (Woinarski and Hill, 2012).
Northern Brush-tailed Phascogale (*Phascogale pirata*)	EPBC vulnerable NT endangered	**Possible**. Pipeline well south of recent records although old records exist from around Katherine and Gove. Preferred habitats present in site including tall open forests dominated by *Eucalyptus miniata and E. tetrodonta* (Woinarski and Ward, 2012a).
Northern Hopping-mouse (*Notomys aquilo*)	EPBC vulnerable NT vulnerable	**Unlikely**. Largely restricted to sandy substrates, particularly those supporting floristically diverse heathlands and / or grasslands (Woinarski et al., 1999 as cited in Alcan Gove, 2004). Majority of specimens known from Groote Eylandt and coastal north-eastern Arnhem Land and preferred habitat not present.
Northern Quoll (*Dasyurus hallucatus*)	EPBC endangered NT critically endangered	**Likely**. Preferred habitat occurs across full length of the pipeline and this species has been recorded to the west of the pipeline route. Preferred habitat consists of some form of rocky area or structurally diverse woodland or forest for denning / shelter purposes, with surrounding vegetated habitats used for foraging and dispersal (DSEWPaC 2011a and DSEWPaC 2013f), with sandstone escarpment considered prime habitat (Braithwaite and Griffiths, 1994).
Reptiles		
Plains Death Adder (*Acanthophis hawkei*)	EPBC Vulnerable	**Unlikely**. Preferred habitat for this species is restricted to flat, treeless, cracking-soil riverine floodplains. This habitat does not occur in the survey area.

*Likelihood definitions:

Highly unlikely – No preferred habitat in unsurveyed section and known populations a large distance away from the area.

Unlikely – Preferred habitat or similar available in unsurveyed section and known populations a large distance away from the area.

Possible – Preferred habitat or similar available in unsurveyed section and known populations in close proximity to the corridor.

Likely – Preferred habitat occurs in unsurveyed section and the known distribution encompasses the area.

Table 4-5: Target species for the fauna survey north of Mitchell Ranges

SPECIES	LIKELIHOOD OF OCCURRENCE	EPBC STATUS	NT STATUS
Birds			
Melville Cicadabird (*Coracina tenuirostris melvillensis*)	Possible	Migratory	Not listed
Northern Crested Shrike-tit (*Falcunculus frontatus whitei*)	Likely	Vulnerable	Not listed
Red Goshawk (*Erythrotriorchis radiatus*)	Likely	Vulnerable	Vulnerable
Mammals			
Brush-tailed Tree Rat (*Conilurus penicillatus*)	Possible	Vulnerable	Endangered
Northern Brush-tailed Phascogale (*Phascogale pirata*)	Possible	Vulnerable	Endangered
Northern Quoll (*Dasyurus hallucatus*)	Likely	Endangered	Critically endangered

Trapping and remote cameras

The fauna survey employed a combination of techniques to detect target species. These were Elliott traps, cage traps, remote infra-red cameras and funnel traps.

Trapping was undertaken at four sites (Table 4-6, Figure 4-13). At each site, a trap line was established comprising:

- 20 type A Elliott traps spaced at approximately 10 to 25 m intervals.
- Three to five wire cage traps (500 mm x 250 mm x 250 mm treadle activated) placed in locations deemed to be optimal for target species.
- Four or five remote cameras (Reconyx HC 500 and HC 600 set to capture five images/sec then reactivate immediately) with a lure/bait, placed in locations deemed ideal for remote cameras.

Traps were deployed for four nights, and checked daily within two hours of dawn. Elliott and cage traps were closed when checked in the morning and reopened each evening so as to avoid any animals captured during the day suffering heat stress. Elliott and cage traps were baited with universal bait (a combination of oats, peanut butter and honey at a ratio of 3:3:1) and a small amount of dry cat food was added to the cage traps to attract carnivorous fauna, such as Northern Quolls. Bait was replaced when required (i.e. when the baits were too dry or covered in ants).

Four or five remote cameras were deployed with each trap line. A combination of Reconyx HC500 and HC600 (infra-red semi-covert and covert respectively) were used. The remote cameras are motion activated. Each camera was set to capture five pictures at one second intervals when movement was detected by its sensors. Once the fifth picture was captured, the remote cameras were immediately reactivated. Lures/baits were used to attract fauna within the range of the sensors. Universal bait, dry cat food and dried liver was contained in a conical PVC tube secured to the ground, within a rocky outcrop, to a tree or log. Remote cameras were secured to a tree (or in some case, high up on top of a rocky outcrop) and aimed towards the lure. Remote cameras were

positioned in relatively open areas and aimed along tracks/game trails where they were present. Smaller vegetation within the range of the remote camera sensor was trimmed to avoid swaying vegetation triggering the sensor. In some instances, cameras were aimed at cage traps where there was a high amount of ground vegetation. Remote camera images were analysed and species identified.

At each site, in the vicinity of each trap line, a 30 m long drift fence was established with five pairs of funnel traps (i.e. one on either side of the drift fence) spaced at approximately five to six metre intervals. No lure or bait was used to attract animals into the funnel traps.

Table 4-6: Summary of traps used at each trap site

TRAP TYPE	NUMBER OF TRAPS				TOTAL
	Site 1	Site 2	Site 3	Site 4	
Elliott	20	20	20	20	80
Cage	4	4	5	3	16
Funnel	10	10	10	10	40
Remote camera	5	4	5	4	18

Broadcast surveys

Small areas of habitat suitable for Northern Crested Shrike-tit were present in the study area (typically *Eucalyptus tectifica, Corymbia latifolia* and *C. grandifolia* woodland (Ward 2008)). Call broadcast (or call playback) surveys were undertaken for the Northern Crested Shrike-tit (*Falcunculus frontatus whitei*), since this species is known to respond to calls and is otherwise difficult to detect. Northern Crested Shrike-tit calls, including territorial calls and chuckling or chattering calls (Plowright 2007) were broadcast from an iPhone via a small portable speaker as follows:

- Broadcast the call of the Northern Crested Shrike-tit for two minutes.
- Listen for a response for at least five minutes, and use binoculars to identify any active birds in the area.
- Move the player 100 m and repeat.
- Four repeats of the survey were conducted at each site.

Surveys were conducted at two sites (Figure 4-14) on 12 May between 12 and 2 pm.

Bird surveys

Between 9 and 13 May, bird surveys were conducted at each trap line and at four additional sites (eight in total) (Figure 4-15). Observations were made for 20 to 30 minutes between 8 and 9 am. All birds observed or identified from call were recorded. Riparian, rocky outcrop and eucalypt woodland habitats were chosen for the surveys to represent habitat diversity.

Spotlighting

Spotlight surveys were conducted at five sites over five nights between 8 and 12 May. Two spotlight surveys were conducted at water sources and creek beds identified during daytime surveys; one was conducted in a disused gravel pit; one while driving slowly along the Central Arnhem Road between KP410 and KP430 and one alongside the rocky outcrop adjacent to trap line 1 (Figure 4-16). Four to

five observers completed the spotlight survey at each site using head-mounted LED (light emitting diode) torches, handheld torches and binoculars for one hour.

Incidental observations

All fauna observed while travelling between sites outside of formal trapping procedures were recorded as incidental observations or opportunistic sightings. Signs of animal activity including tracks, diggings and scats were also recorded.

Compliance with EPBC survey guidelines

The DSEWPaC guidelines for survey of Australia's threatened fauna (DEWHA 2008 and 2010 for mammals and birds, respectively) were incorporated into the survey design and methodology for target species. While the unsurveyed area is approximately 360 ha in size (36 km x 100 m), survey areas were biased towards selected habitat types based on our understanding of the ecology of the target species (for example the area of riverine vegetation targeted in the unsurveyed area was approximately 14 ha). Therefore, in most cases the methodology complied with the survey guidelines, or was modified according to discussions with local authorities in the target species (Table 4-7).

Summary of field techniques applied

Table 4-8 provides a summary of survey techniques used at each site.

Limitations

All work was undertaken under the supervision of a senior Aboriginal traditional owner which in some cases limited the distances that could be travelled by foot.

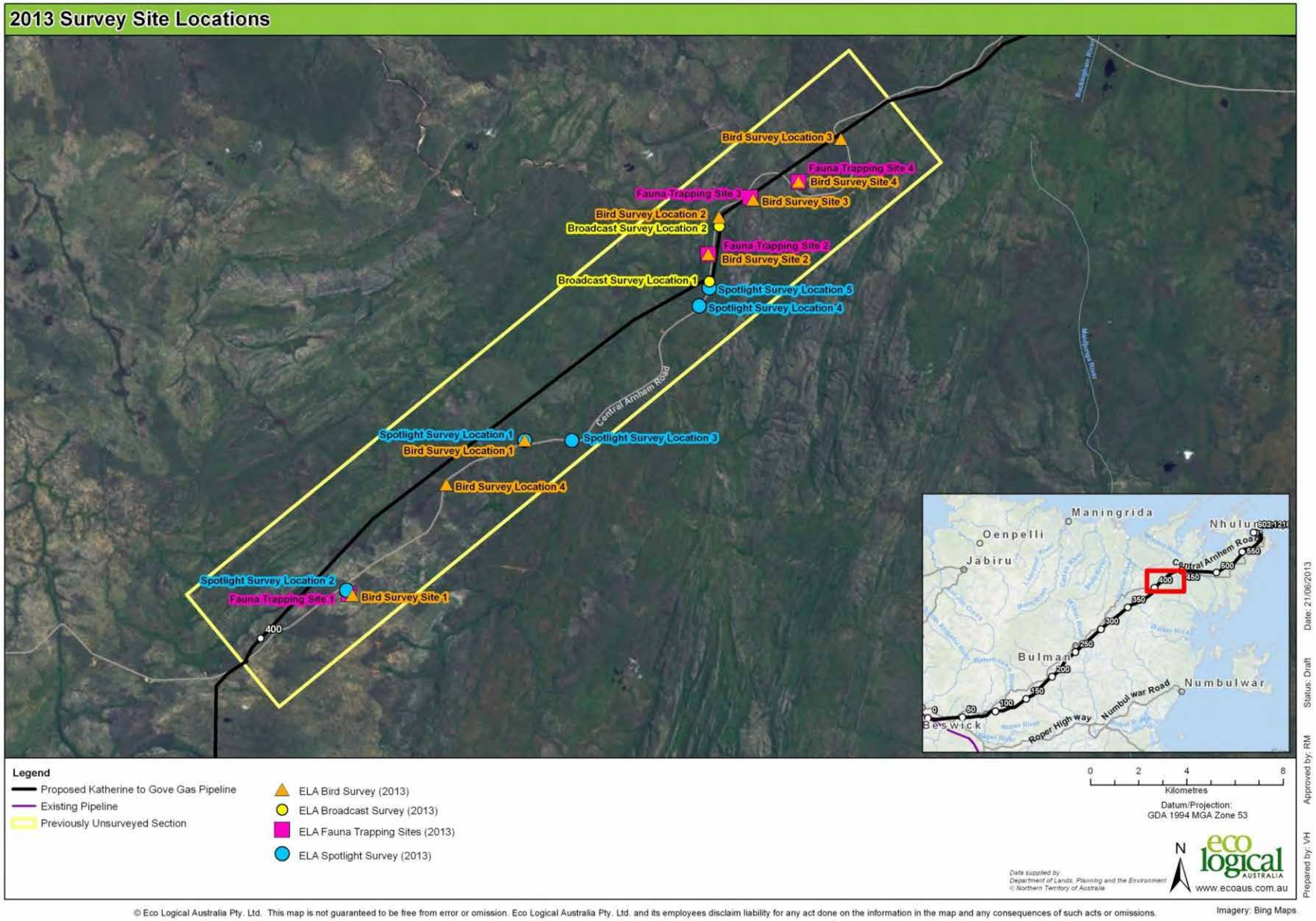


Figure 4-13: Summary of fauna survey locations in the previously unsurveyed area to the north of the Mitchell Ranges

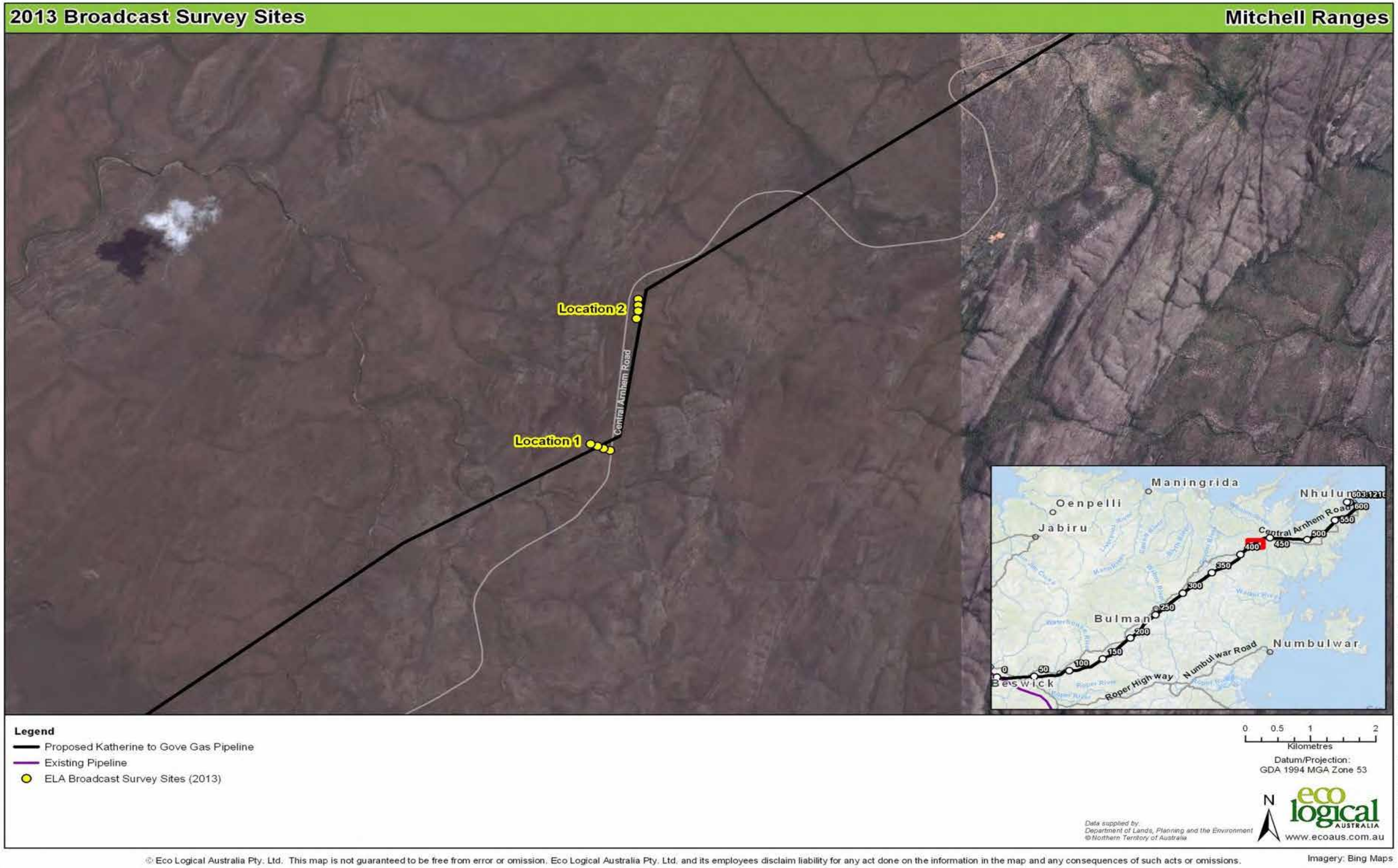


Figure 4-14: Broadcast survey sites in the previously unsurveyed area to the north of the Mitchell Ranges

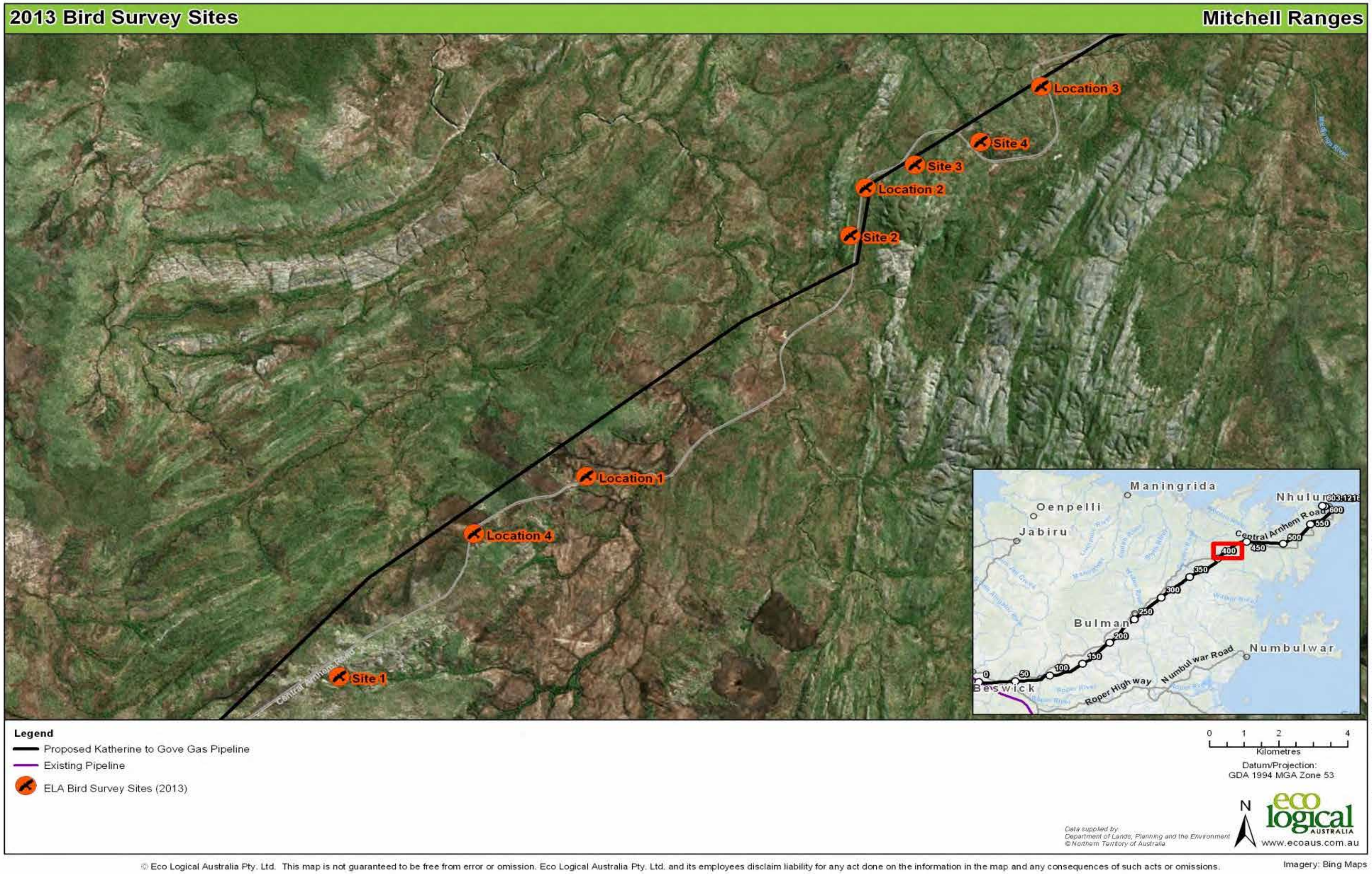


Figure 4-15: Bird survey sites (at trap lines) and locations (away from trap lines) in the previously unsurveyed area to the north of the Mitchell Ranges

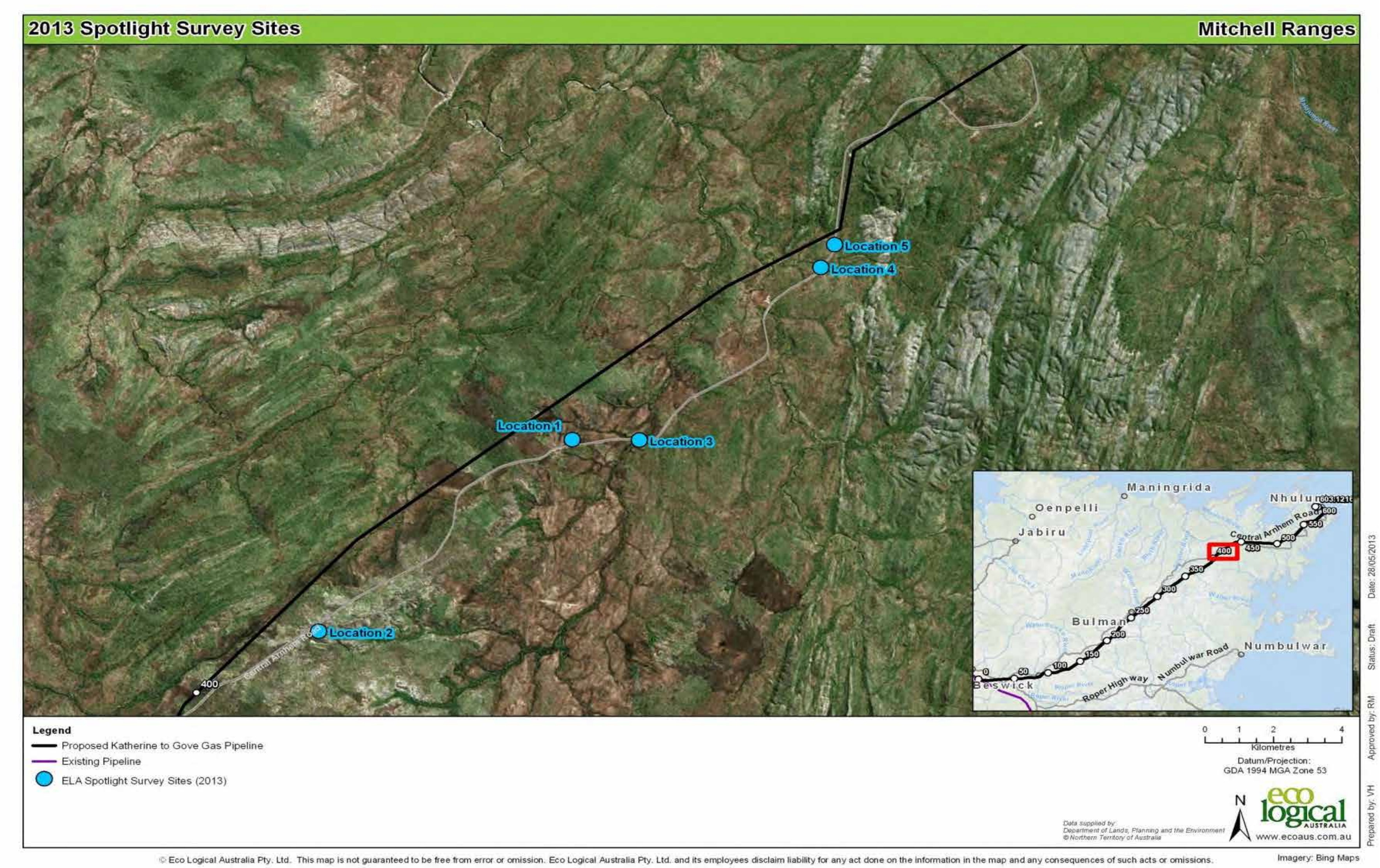


Figure 4-16: Spotlight survey sites in the previously unsurveyed area to the north of the Mitchell Ranges

Table 4-7: A comparison of the DSEWPaC survey guidelines for the target species and the survey methods used in the survey

METHOD	TARGET SURVEYS	DSEWPAC RECOMMENDED SURVEY EFFORT	ELA 2013 SURVEY EFFORT	JUSTIFICATION FOR DEVIATION
Daytime searches for potentially suitable habitat resources, potential nest sites, signs of activity	Brush-tailed Tree Rat (*Conilurus penicillatus*) Northern Brush-tailed Phascogale (*Phascogale pirata*) Northern Quoll (*Dasyurus hallucatus*)	For large and remote areas, identify habitat resources through ground-truthing after reviewing aerial photos, vegetation maps and discussion with local people and traditional owners	Reviewed previous records and data, and discussed with agency staff and Aboriginal traditional owners. In field searches for potentially suitable habitat were conducted during site reconnaissance, deployment of trap lines and bird surveys at other locations	N/A
Cage and Elliott trapping program	Brush-tailed Tree Rat (*Conilurus penicillatus*)	Ten cage traps oriented in two parallel lines of five traps, spaced at 50 m intervals. Cages set for four consecutive nights 20 Elliott A traps oriented in two parallel lines of ten traps, spaced at ten metre intervals. Distance between the two parallel lines is 25 m. Traps set for four consecutive nights	Three to five cage traps and 20 Elliott traps were set for four consecutive nights per site. Traps were spaced at 10 to 25 m intervals in linear transects	Few cage traps used as higher emphasis placed on remote cameras. One linear Elliott trap line used as riverine habitat is narrow. Traps lines in rocky outcrops meandered according to the rock layout and ideal trap locations.
Cage and Elliott trapping program	Northern Quoll (*Dasyurus hallucatus*)	Four nights (minimum of four cage traps) for sites up to five hectares, particularly in rocky habitat	Three to five cage traps and 20 Elliot traps were set for four consecutive nights per site. Traps were spaced at 10 to 25 m intervals in linear transects.	Few cage traps used as higher emphasis placed on remote cameras. One linear Elliott trap line used as riverine habitat is narrow. Traps lines in rocky outcrops meandered according to the rock layout and ideal trap locations. Discussed occurrence of species with Aboriginal traditional owners.

METHOD	TARGET SURVEYS	DSEWPAC RECOMMENDED SURVEY EFFORT	ELA 2013 SURVEY EFFORT	JUSTIFICATION FOR DEVIATION
Spotlight surveys	Brush-tailed Tree Rat (*Conilurus penicillatus*) Northern Brush-tailed Phascogale (*Phascogale pirata*) Northern Quoll (*Dasyurus hallucatus*)	Two 200 metre transects per five hectare site	Nocturnal spotlighting surveys were conducted at five sites over five nights. Each survey lasted for one hour (a total of 23 person hours of effort). Transects were at least 200 m.	Survey effort was not repeated due to the number of observers, time limitation and in an attempt to survey a broad area of suitable habitat.
Remote cameras	Northern Brush-tailed Phascogale (*Phascogale pirata*) Northern Quoll (*Dasyurus hallucatus*)	Ten cameras per hectare, set for at least 14 nights	Four or five cameras were set for four nights per site (approximately 0.5 ha).	Remote cameras used in previous survey (Nov 2012, Draft EIS, Appendix D) over 14 days. Additional survey effort constrained by time.
Consultation	Northern Brush-tailed Phascogale (*Phascogale pirata*) Northern Quoll (*Dasyurus hallucatus*)	Consult with communities to locate the species	Consulted with ranger groups, TOs, government agencies and experts	NA
Stagwatching surveys	Northern Brush-tailed Phascogale (*Phascogale pirata*)	Commence survey 30 minutes before dusk and continue 60 minutes after sunset	None	Other survey techniques were used to detect the species
Hair sampling	Northern Brush-tailed Phascogale (*Phascogale pirata*) Northern Quoll (*Dasyurus hallucatus*)	For a site up to five hectares, at least three sites should be used with 20 devices per site open for 14 consecutive nights	None	Hair sampling used in previous survey (survey Nov 2012, Draft EIS, Appendix D)
Arboreal trapping – Elliott B traps	Northern Brush-tailed Phascogale (*Phascogale pirata*)	Ten Elliott B traps oriented in two parallel lines of five traps, erected two to four metres above the ground on a secure platform, and spaced at 50 m intervals. Traps set for four consecutive nights	None	Other survey techniques were used to detect the species

Table 4-8: Summary of survey effort at each site

SITE	LOCATION (KP)	HABITAT	SURVEY EFFORT
Trap lines			
Trap line 1	404	Rocky outcrop / Eucalypt woodland boundary	20 Elliott traps (type A) x 4 nights 4 cage traps x 4 nights 5 remote cameras x 4 nights 10 funnel traps x 4 nights
Trap line 2	425	Rocky outcrop / monsoon vine thicket boundary	20 Elliott traps (type A) x 4 nights 4 cage traps x 4 nights 4 remote cameras x 4 nights 10 funnel traps x 4 nights
Trap line 3	428	Riparian corridor / Eucalypt woodland boundary	20 Elliott traps (type A) x 4 nights 5 cage traps x 4 nights 5 remote cameras x 4 nights 10 funnel traps x 4 nights
Trap line 4	430	Eucalypt woodland boundary adjacent to riparian corridor	20 Elliott traps (type A) x 4 nights 3 cage traps x 4 nights 4 remote cameras x 4 nights 10 funnel traps x 4 nights
Bird survey			
Trap line 1	404	Rocky outcrop / Eucalypt woodland boundary	2 people x 20 min
Trap line 2	425	Rocky outcrop / vine thicket boundary	2 people x 30 min
Trap line 3	428	Riparian corridor / Eucalypt woodland boundary	2 people x 20 min
Trap line 4	430	Eucalypt woodland boundary adjacent to riparian corridor	2 people x 20 min
Bird survey location 1	413.5	Overgrown gravel pit (= spotlight location 1)	2 people x 30 min (plus opportunistic observations)
Bird survey location 2	426.6	Eucalypt woodland	2 people x 20 min
Bird survey location 3	432.5	Eucalypt woodland and soak/spring area	2 people x 20 min
Bird survey location 4	410	Eucalypt woodland	2 people x 30 min
Broadcast survey			
Broadcast survey 1	424	*Eucalyptus tectifica, Corymbia latifolia* and *C. grandifolia* woodland	4 call broadcast surveys; 4 people x 28 min
Broadcast survey 2	426	*Eucalyptus tectifica, Corymbia latifolia* and *C. grandifolia* woodland	4 call broadcast surveys; 4 people x 28 min

Spotlight survey			
Spotlight location 1	413.5	Overgrown gravel pit (= bird survey location 1)	5 people x 60 min
Spotlight location 2	404	Adjacent trap line 1, rocky outcrop / vine thicket	5 people x 60 min
Spotlight location 3	415	Riparian vegetation corridor	4 people x 60 min
Spotlight location 4	423	Riparian vegetation corridor	4 people x 60 min
Spotlight location 5	423.8	Central Arnhem highway between KP410 and KP430	5 people x 60 min

4.4.3 Results

Overview

One hundred and eight native species and four introduced species were recorded during the survey. This included 63 birds, nine native mammals, 30 reptiles and six amphibians (Table 4-9). Of these species two were of conservation significance: the Rainbow Bee-eater and Mertens Water Monitor.

Trapping and remote cameras

Only one mammal (Grassland Melomys, *Melomys burtoni*) and two reptile species (Robust Ctenotus, *Ctenotus robustus* and Douglas' Skink, *Eremiascincus douglasi*) were captured during 320 Elliott trap nights. One hundred and sixty funnel trap nights captured three amphibian and 17 reptile species, and no fauna were captured during 64 cage trap nights. Two species (one bird and one reptile) were recorded by remote cameras over four days (Torresian Crow (*Corvus orru*) at Sites 3 and 4; and an unidentified *Ctenotus* at Site 3) (Table 4-9).

Broadcast survey

No Northern Crested Shrike-tit calls were recorded during the two surveys on 12 May 2013.

Bird survey

Bird surveys conducted in conjunction with the trap lines recorded 17 species, while 31 species were recorded during birds surveys conducted outside of the trap lines (Table 4-9). None of the target species were recorded.

Spotlight survey

Spotlight surveys recorded three native amphibian species, ten bird species, four mammals, six reptiles and one introduced amphibian (Table 4-9).

Incidental observations

Opportunistic observations made while traveling around the survey area and trap lines, and indirect evidence (diggings and scats), resulted in records of an additional amphibian species, 36 bird species, five native mammals, 11 reptiles and three introduced species (Table 4-9). Opportunistic observations recorded the EPBC Act listed migratory Rainbow Bee-eater (*Merops ornatus*) and the NT (TPWC) Vulnerable Mertens Water Monitor (*Varanus mertensi*) near trap line 3.

4.4.4 Fauna conservation values of the previously unsurveyed area

One hundred and eight native fauna species and four introduced species were recorded during the survey. Seventeen of these species were not recorded in the pipeline corridor during the 2004 or 2012 surveys (EcOz 2004; Pacific Aluminium 2013) (Table 4-9). Although sandstone/rocky outcrops were surveyed, none of the species recorded for the first time by this 2013 survey are sandstone habitat specialists.

EPBC Act migratory species

The Rainbow Bee-eater (*Merops ornatus)* is a listed migratory species under the EPBC Act and was observed at various locations throughout the survey period.

Northern Territory threatened species

One Mertens Water Monitor (*Varanus mertensi*, NT Vulnerable) was observed at a water hole within the main creek adjacent to trap line 3.

Introduced species

Introduced species, including cane toads, cats, pigs and buffalo, were recorded during the survey. Their impacts were most evident in riparian zones where buffalo and pigs wallow and cane toads breed. One cat was recorded which is consistent with findings from across the pipeline that cats are widespread at low density throughout the project area (Draft EIS, Appendix D).

Habitat values

The primary habitat types and features in the survey area were:

- Woodland (*E. tetradonta* and *E. miniata* woodland, and *E. tectifica*, *C. latifolia* and *C. grandiflora* woodland).
- Riparian woodland and forest.
- Rock outcrops.
- Monsoon vine thicket.

Woodland was the predominant habitat throughout the survey area. At the end of the wet season, woodlands consisted of a 15 to 25 m canopy with a sparse shrub layer and ground layer, often dominated by *Sorghum* spp. The litter layer was typically sparse (a reflection of fire history) with occasional logs and woody debris.

Riparian woodland and forest-lined watercourses in the survey area. Vegetation was often dense along the riparian fringe, but rarely extended 20 m beyond the top of bank. *Pandanus* sp., *Melaleuca* spp. and the Freshwater Mangrove (*Barringtonia acutangula*) were common, with *Acacia* sp. and other shrubs in the understorey over a grassy ground cover.

Sandstone rock outcrops were found only in three locations in the survey area. They varied from deeply embedded rock on rises, to surface rock to larger, fractured sandstone extrusions. Vegetative cover varied depending on soil depth, but rock outcrops were always amongst woodland.

A monsoon vine thicket was present east of a rocky rise at trap line 2. It was characterised by a dense overstorey of mesic trees and shrubs, an entanglement of vines and a rocky sparse ground cover.

Section 4.2 provides additional detail on vegetation communities in the surveyed area.

Table 4-9: Species recorded in the 2013 survey of the previously unsurveyed section and those recorded in 2004 and 2012 surveys across the remainder of the pipeline corridor (Note that species indicated in bold are those not previously observed in the 2004 and/or 2012 surveys)

CATEGORY	COMMON NAME	SCIENTIFIC NAME	SITE / LOCATION							PREV. RECORD	
			1	2	3	4	BS	S	OP	2004	2012
Amphibian	**Bilingual Froglet**	***Crinia bilingua***			**OP**				**x**		
	Floodplain Toadlet	***Uperoleia inundata***				**F**					
	Marbled Frog	*Limnodynastes convexiusculus*						x		x	x
	Ornate Burrowing Frog	*Platyplectrum ornatus*				F				x	x
	Pale Tree-frog	*Litoria pallida*			F	F		x		x	
	Rocket Frog	*Litoria nasuta*						x		x	x
Bird	Australian Owlet-nightjar	*Aegotheles cristatus*						x	x	x	x
	Banded Honeyeater	*Cissomela pectoralis*					x		x	x	x
	Bar-breasted Honeyeater	*Ramsayornis fasciatus*						x		x	x
	Bar-shouldered Dove	*Geopelia humeralis*			BS	BS	x			x	x
	Black-breasted Buzzard	*Hamirostra melanosternon*	BS						x	x	x
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*					x		x	x	x
	Black-tailed Treecreeper	*Climacteris melanura*	BS							x	x
	Blue-faced Honeyeater	*Entomyzon cyanotis*					x		x	x	x
	Blue-winged Kookaburra	*Dacelo leachii*					x		x	x	x
	Brown Goshawk	*Accipiter fasciatus*							x	x	x
	Brown Honeyeater	*Lichmera indistincta*					x			x	x
	Budgerigar	*Melopsittacus undulatus*							x		x
	Bush Stone-curlew	***Burhinus grallarius***						**x**			
	Cockatiel	*Nymphicus hollandicus*							x	x	x
	Collared Sparrowhawk	*Accipiter cirrocephalus*							x		x
	Common Bronzewing	*Phaps chalcoptera*					x			x	x

CATEGORY	COMMON NAME	SCIENTIFIC NAME	SITE / LOCATION							PREV. RECORD	
			1	2	3	4	BS	S	OP	2004	2012
	Crimson Finch	*Neochmia phaeton*							x	x	x
	Diamond Dove	*Geopelia cuneata*			x				x	x	x
	Double-barred Finch	*Taeniopygia bichenovii*							x	x	x
	Dusky Honeyeater	*Myzomela obscura*			x		x			x	x
	Galah	*Eulophus roseicapilla*							x	x	x
	Great Bowerbird	*Ptilonorhynchus nuchalis*							x	x	x
	Grey Butcherbird	*Cracticus torquatus*			x		x				x
	Grey Shrike-thrush	*Colluricincla harmonica*					x				x
	Grey-crowned Babbler	*Pomatostomus temporalis*					x			x	x
	Helmeted Friarbird	*Philemon buceroides*			x		x			x	
	Leaden Flycatcher	*Myiagra rubecula*						x		x	x
	Little Woodswallow	*Artamus minor*							x		x
	Magpie-lark	*Grallina cyanoleuca*					x		x		x
	Masked Finch	*Poephila personata*							x	x	x
	Mistletoebird	*Dicaeum hirundinaceum*							x	x	x
	Nankeen Night Heron	*Nycticorax caledonicus*						x	x		x
	Northern Fantail	*Rhipidura rufiventris*							x	x	x
	Northern Rosella	*Platycercus venustus*					x		x	x	x
	Pacific Baza	***Aviceda subcristata***							**x**		
	Peaceful Dove	*Geopelia striata*			x		x		x	x	x
	Pheasant Coucal	*Centropus phasianinus*							x	x	x
	Pied Butcherbird	*Cracticus nigrogularis*					x			x	x
	Rainbow Bee-eater	*Merops ornatus* (EPBC Migratory)							x	x	x
	Rainbow Lorikeet	*Trichoglossus haematodus*			x		x		x	x	x

CATEGORY	COMMON NAME	SCIENTIFIC NAME	SITE / LOCATION							PREV. RECORD	
			1	2	3	4	BS	S	OP	2004	2012
	Red-backed Fairy-wren	*Malurus melanocephalus*			x					x	x
	Red-tailed Black-cockatoo	*Calyptorhynchus banksii*					x		x	x	x
	Red-winged Parrot	*Aprosmictus erythropterus*					x	x	x	x	x
	Rufous Whistler	*Pachycephala rufiventris*					x		x	x	x
	Silver-crowned Friarbird	*Philemon argenticeps*					x			x	x
	Southern Boobook	*Ninox novaeseelandiae*						x		x	x
	Spangled Drongo	*Dicrurus bracteatus*						x		x	x
	Spotted Nightjar	*Eurostopodus argus*						x	x	x	
	Straw-necked Ibis	*Threskiornis spinicollis*				x	x		x		x
	Striated Pardalote	*Pardalotus striatus*					x			x	x
	Sulphur-crested Cockatoo	*Cacatua galerita*		x	x					x	x
	Tawny Frogmouth	*Podargus strigoides*						x	x	x	x
	Torresian Crow	*Corvus orru*			x	x	x			x	x
	Varied Lorikeet	*Psitteuteles versicolor*			x		x			x	x
	Wedge-tailed Eagle	*Aquila audax*							x	x	x
	Weebill	*Smicrornis brevirostris*					x			x	x
	Whistling Kite	*Haliastur sphenurus*							x	x	x
	White-bellied Cuckoo-shrike	*Coracina papuensis*					x		x	x	x
	White-gaped Honeyeater	*Lichenostomus unicolor*			x		x			x	x
	White-necked Heron	*Ardea pacifica*							x	x	x
	White-throated Gerygone	*Gerygone albogularis*			x		x			x	x
	White-throated Honeyeater	*Melithreptus albogularis*			x		x			x	x
	Yellow-throated Miner	*Manorina flavigula*					x			x	x
Mammal	Agile Wallaby	*Macropus agilis*							x	x	x

CATEGORY	COMMON NAME	SCIENTIFIC NAME	SITE / LOCATION							PREV. RECORD	
			1	2	3	4	BS	S	OP	2004	2012
	Black Flying Fox	*Pteropus alecto*						x		x	
	Common Wallaroo	*Macropus robustus*							IE		x
	Dingo	*Canis lupus*						x	x	x	x
	Echidna	***Tachyglossus aculeatus***	**IE**						**x**		
	Grassland Melomys	*Melomys burtoni*			E					x	x
	Little-red Flying Fox	*Pteropus scapulatus*						x		x	
	Orange Leaf-nosed Bat	***Rhinonicteris aurantia***							**x**		
	Sugar Glider	***Petaurus breviceps***						**x**			
Reptile	Skink	*Carlia* sp.				F					
	Skink	*Ctenotus* sp.				F					
	Whipsnake	*Demansia* sp.							x		
	Black-Headed Python	***Aspidites melanocephalus***							**x**		
	Brown Tree Snake	***Boiga irregularis***						**x**			
	Burton's Legless Lizard	***Lialis burtonis***							**x**		
	Bynoe's Gecko	*Heteronotia binoei*	F					x	x	x	x
	Children's Python	*Antaresia childreni*							x	x	x
	Common Blue-tongued Lizard	***Tiliqua scincoides***							**x**		
	Douglas' Skink	***Eremiascincus douglasi***			**E**	**F**					
	Frilled Lizard	***Chlamydosaurus kingii***							**x**		
	Gilbert's Dragon	*Lophognathus gilberti*			F					x	x
	Green Tree Snake	*Dendrelaphis punctulata*						x		x	x
	Keelback	*Tropidonophis mairii*			F					x	x
	King Brown Snake	*Pseudechis australis*				F					
	Marbled Velvet Gecko	*Oedura marmorata*		F				x		x	

CATEGORY	COMMON NAME	SCIENTIFIC NAME	SITE / LOCATION							PREV. RECORD	
			1	2	3	4	BS	S	OP	2004	2012
	Mertens Water Monitor	***Varanus mertensi* (NT Vulnerable)**			**OP**				**x**		
	Metallic Snake-eyed Skink	*Cryptoblepharus metallicus*			F						x
	Northern Death Adder	***Acanthophis praelongus***			**F**						
	Northern Dtella	*Gehyra australis*						x			x
	Plain Ctenotus	*Ctenotus inornatus*	F		F					x	x
	Port Essington Ctenotus	*Ctenotus essingtonii*			F					x	
	Robust Ctenotus	***Ctenotus robustus***	**F**	**E**	**F**						
	Scant-striped Ctenotus	*Ctenotus vertebralis*				F				x	
	Slender Rainbow Skink	*Carlia gracilis*			F					x	x
	Spotted Tree Monitor	*Varanus scalaris*	F						x	x	x
	Striped Rainbow Skink	*Carlia munda*				F				x	x
	Two-Lined Dragon	*Diporiphora bilineata*	F					x		x	
	Two-Spined Rainbow Skink	*Carlia amax*	F		F				x	x	x
	Western Brown Snake	***Pseudonaja nuchalis***							**x**		
Introduced species	Cane Toad	*Rhinella marina*						x	x	x	x
	Cat	*Felis catus*							x		x
	Pig	*Sus scrofa*				IE					x
	Swamp Buffalo	*Bubalus bubalis*	IE	IE	IE	IE			x	x	x

Key: (S)=Spot lighting, (C)=Call only, (BS)=Bird Survey, (OP)=Opportunistic, (T)=Trapping, (F)=Funnel, (IE)=Indirect Evidence and (G)=Goyder River.

4.5 GOULDIAN FINCH RESOURCE SURVEY

4.5.1 Introduction

The Gouldian Finch (*Erythrura gouldiae)* is listed as Endangered and Migratory under the EPBC Act and Vulnerable under the TPWC Act. The species is known to occur in the vicinity of the proposed pipeline corridor (ALA 2013, EcOz 2004) and flocks of up to 400 individuals were recorded during surveys conducted by Eco Logical Australia at the end of the 2012 dry season (near KP118) (Appendix D, Draft EIS). Seven individuals were recorded in earlier pipeline related work conducted by EcOz in the mid-dry season of 2004. Habitat that may be suitable for Gouldian Finches has also been identified based on the flora field survey (Appendix C, Draft EIS) and analysis of GIS mapping (Appendix F, Draft EIS).

4.5.2 Gouldian Finch habitat use and characteristics of breeding (and coincident dry season foraging) habitat

Gouldian Finches shift habitat throughout the year following seasonal food resources. In the dry season (April to November) they primarily forage on burnt ground for exposed annual grass seeds close to breeding habitat in hilly woodland. As the annual grass seed bank is depleted and the breeding season ends, foraging shifts to a sequence of seeding perennial grasses typically distributed in adjacent lowlands. Nests are formed using grass placed inside hollows (created by termites) in smooth barked Eucalypts, where breeding pairs produce an average of three clutches of eggs each year.

Gouldian Finches are known to use a variety of trees for breeding. In the region traversed by the pipeline corridor, suitable nesting habitat primarily occurs in woodland dominated by Salmon Gums (*Eucalyptus tintinnans*). Gouldian Finches drink daily and must have access to water year-round. It has been observed that Gouldian Finches nest within two to four kilometres of water during the breeding season, but may travel up to ten kilometres for water and foraging grasses during the non-breeding season (Dostine et al. 2001, O'Malley 2006, Tidemann 1996). In the late dry season, persistent water sources with suitable shallow edges are a critical resource (O'Malley 2006).

Given the seasonal variability of resource use, breeding (and coincident dry season foraging) habitat for Gouldian Finches, is defined as the combination of several habitat features in close proximity (O'Malley 2006). Breeding populations of Gouldian Finches require a combination of:

- Patches of woodland greater than one hectare dominated by *Eucalyptus tintinnans,* to cater for multiple nesting pairs within close proximity;
- Surrounding areas with favoured wet and dry season seeding grasses; and
- Perennial streams, waterholes or springs within four kilometres of the above.

4.5.3 Gouldian Finch records and predicted habitat in the eastern section of the KGGP

Records from the NT Fauna Atlas from the last 20 years (ALA 2013) and fauna surveys conducted along the pipeline (presented at Appendix D, Draft EIS) suggest that most records of the species in the proposed pipeline corridor occur in the south-west of the corridor between KP0-KP140 (Figure 4-17). There are also two records of the species within 15 km of the pipeline further north-east between KP290 and KP320 (a segment of pipeline between Bulman and Barrapunta).

During preparation of the Draft EIS, GIS analysis was used to combine characteristics of vegetation, drainage, water bodies, land systems and geological data to identify potentially suitable Gouldian Finch habitat across the Top End of the Northern Territory (Appendix F, Draft EIS; Figure 4-18). Habitats were modelled using vegetation communities broadly associated with Eucalypt woodland and topography, including hills, plains and rises. Approximately 90% of known Gouldian Finch records are mapped in the area of moderate-higher probability. These results indicate the presence of potentially suitable habitat between KP0-KP140.

4.5.4 Project objectives

To improve current knowledge of Gouldian Finch populations in the pipeline region, establish a basis for impact assessment and provide a framework for management decisions, a study of habitat resources in the area was conducted during the 2013 dry season. Focusing on Gouldian Finch habitat between KP0-KP140, the objectives of the resource survey were to:

- Provide a detailed summary of habitat resources important to Gouldian Finches that may be impacted by the construction and operation of the KGGP.
- Determine the wider availability of these habitat resources, outside and near the ROW, in areas that will not be disturbed during construction.
- Provide current data for design and conduct of ongoing management of populations through monitoring and fire management.

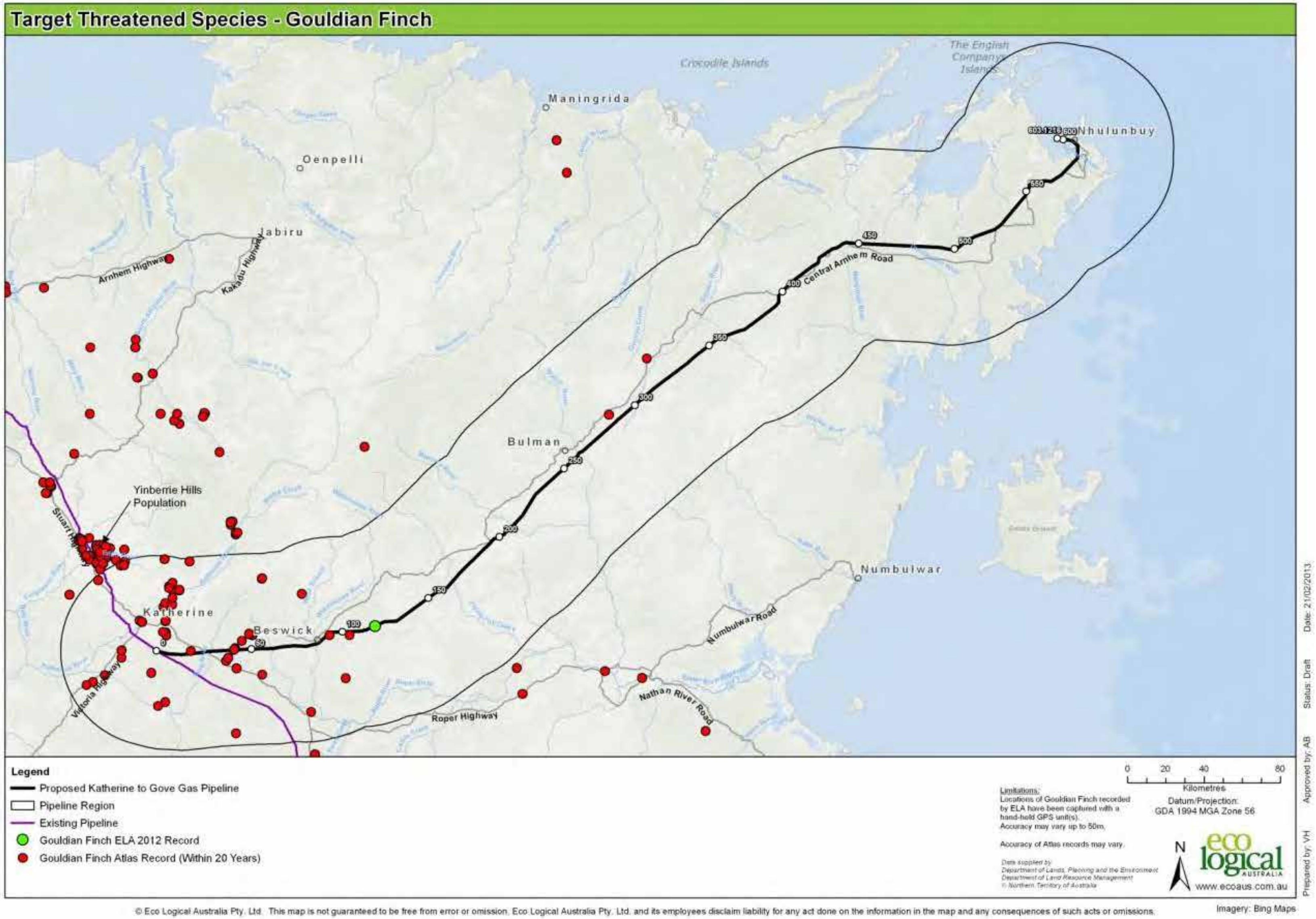


Figure 4-17: Gouldian Finch records in proximity to the project area

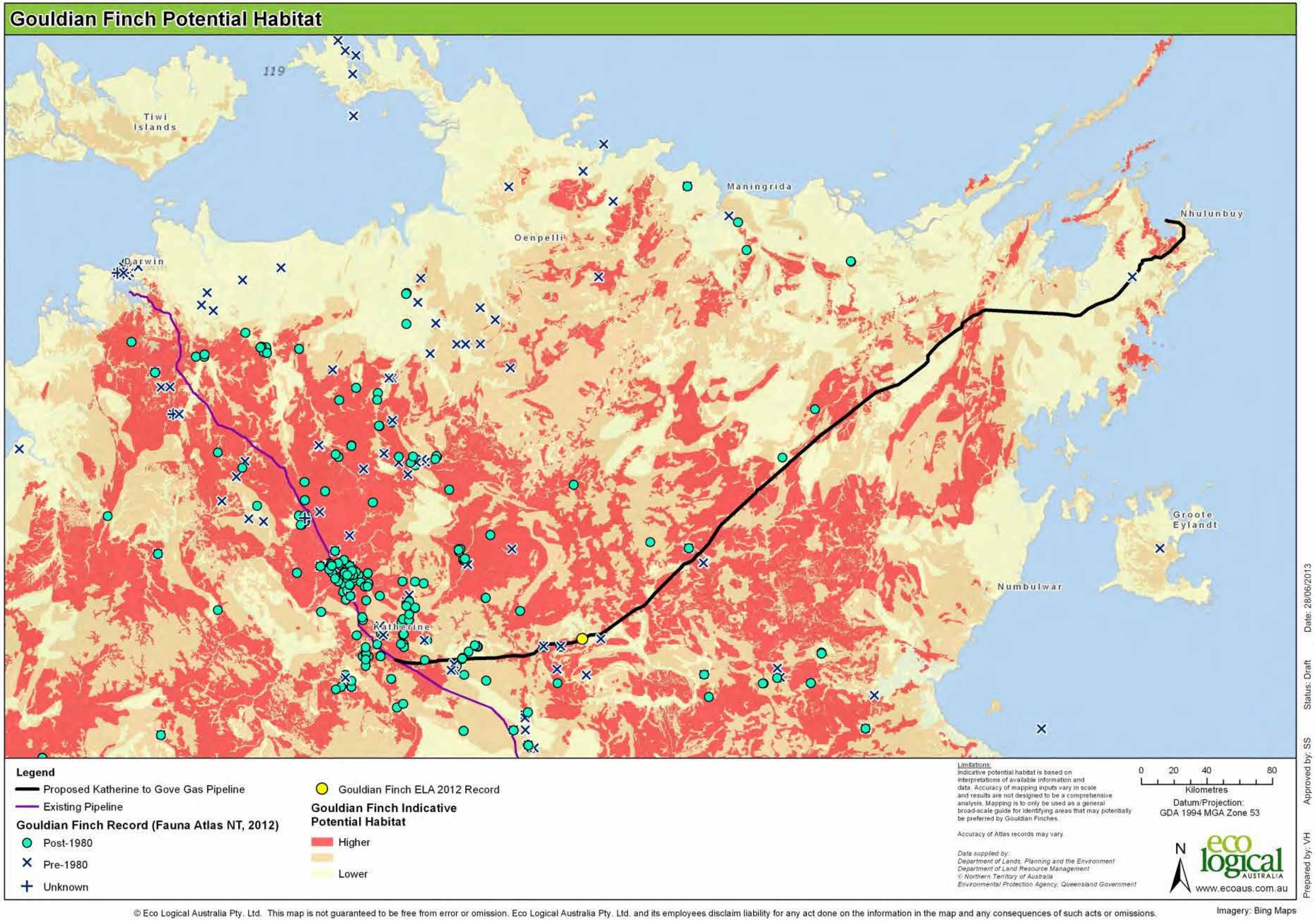


Figure 4-18: Gouldian Finch indicative potential habitat (according to habitat associations) showing existing records

4.5.5 Methods

Aerial surveys for Gouldian Finch habitat

Significant resources for Gouldian Finches that can reliably be surveyed by helicopter include Salmon Gums (*Eucalyptus tintinnans*) and sources of water, particularly those that persist throughout the dry season. Salmon gums have distinctive salmon pink new bark, seasonally present at the time of survey, which allows the species to be identified by aerial survey (Figure 4-19).

Standing water sources in tropical savanna landscapes include billabongs, waterholes, pools, soaks, swamps and wetlands. Seasonally flowing water occurs in streams (creeks and rivers). During the dry season, some ephemeral and intermittent streams dry to chains of pools, and some dry completely. Perennial water sources include streams that flow year-round or hold water in isolated pools throughout the dry season. These perennial waters are critically important for Gouldian Finches late in the dry season, as these areas are often the only drinking source. Perennial water is generally supplied by groundwater springs or seepage, or persists because of the depth of substantial waterholes. The permanency of water at each source was evaluated based on geomorphology, connectivity to larger waterways, aquatic vegetation cover, riparian species, topography and local knowledge. Gouldian Finches prefer to drink from water sources with shallow edges and may favour water sources in shallow wetlands over steep-banked creeks. Although the perennial streams in the region often had steeper banks compared to nearby soaks, the finches would access drinking water by utilising fringing vegetation, woody debris and gentle grades on sand deposits or inside bends. As ephemeral and intermittent sources dry out, the importance of perennial pools remaining in creeks is high.

Although the availability of grass seeds is an element of breeding (and coincident dry season foraging) habitat, the presence of seeds or seed-bearing species cannot be determined with high confidence from aerial surveys; however, seasonal progression of seed availability is characteristic of tropical savannas, and this resource is far less likely to be limiting than suitable breeding or watering habitat. In addition, the highly variable availability of seeds throughout the year and between years means that a single observation during this four-day survey is unlikely to be a reliable indicator of permanent Gouldian Finch population locations. Therefore, emphasis on locating tree habitat in close proximity to permanent water provides a more valuable assessment of core resources.

Each tree and water resource was classified according to the characteristics listed in Table 4-10.

Survey method – habitat resources surrounding the KGGP ROW

Salmon Gums and water sources within two kilometres of the pipeline centreline between KP0 and KP140 (including the proposed alternative tie-in) were surveyed by helicopter over four days from 29 April to 2 May 2013. Four 140 km transects were flown one kilometre apart approximately 90 m above ground level with two observers recording water sources and Salmon Gums within 500 m of each transect (Figure 4-20). A fifth transect was flown directly over the proposed pipeline centreline at a lower altitude and slower speed. Characteristics of all observed resources were described and geo-referenced with a hand-held GPS unit. An additional desktop survey was conducted using aerial imagery to identify perennial water sources within four kilometres of the helicopter transects. This involved visually scanning images to search for perennial streams and large waterholes, and determining their proximity to habitat patches (e.g. where a perennial stream occurred parallel to transects within four kilometres).

Table 4-10: Characteristics recorded for each Gouldian Finch habitat resource identified

CHARACTERISTIC	DESCRIPTORS
Eucalyptus tintinnans	
Size of patch	• <1 ha • 1-5 ha • >5 ha
Patch density	• Single tree • Scattered trees • Dense trees
Other notes	• Presence of tree hollows • Evidence of recruitment • Evidence of fire damage
Water sources	
Type	• Watercourse (creek or river) • Water feature (billabong, farm dam, waterhole, pool, soak, swamp, wetland)
Permanency	• Permanent (holds water throughout dry season) • Temporary (dries up in dry season)
Size (for creeks, rivers and large wetlands)	• Continuous wetted length in metres
Orientation relative to transect	• Parallel • Perpendicular

Survey method – habitat resources within the KGGP Right-of-Way

A more detailed survey was conducted along the pipeline ROW between KP0 and KP140 (including the proposed alternative tie-in). This area was surveyed by flying just above the tree line (approximately 25 m above ground level) with an observer noting the presence of any potential resources. A 100 m wide corridor along the pipeline centreline was assessed to allow for uncertainty associated with use of handheld GPS units and minor navigation differences. Each resource was photographed, a waypoint taken and characteristics recorded. Two sites representing rocky hills and flat areas supporting Salmon Gums were selected for a more complete vegetation community description.

4.5.6 Resource mapping

Field data were mapped using ArcGIS for spatial analysis. Locations of waypoints were repositioned according to offset distance recorded from the helicopter. Watercourse alignments were manually digitised from satellite imagery. Additional water sources outside of the survey area were also identified from imagery (within five kilometres). During this process, several small farm dams were identified but not classed as permanent water resource for finches. This is justified because farm dams may or may not be maintained in the future and should not be relied on as a critical finch resource if other natural habitat is lost due to development.

Breeding (and coincident dry season foraging) habitat was mapped by filtering tree habitat greater than one hectare in size and within four kilometres of a permanent water source. Using a minimum tree habitat patch size of one hectare increases the likely occurrence of suitable nesting trees (those old enough to have hollows) and adequate abundance of trees to support a breeding population.

4.5.7 Limitations

Aerial surveys provide the ability to survey large areas of habitats, but have some limitations. As previously discussed, seed-bearing grasses that are important feeding habitat for Gouldian Finches are extensive, seasonally variable and cannot confidently be identified by aerial surveys over a large area with limited flight time. In addition, where topography is complex, there may be areas that cannot be observed within the 500 m survey area (i.e. where habitat occurs in gullies or behind dense vegetation that cannot be seen from the helicopter). Therefore, there is bias for towards observing and recording resources closer to transect lines and observations will tend to *underestimate* actual distribution and abundance.

The speed of the helicopter reduces the accuracy of waypoints taken with a hand-held GPS unit. The flight speed was slower for the survey directly over the pipeline ROW and faster in surrounding areas. We estimate that waypoints given in this report are accurate to 50 m for the ROW transect and 100 m for all other transects. Also, there may be a further decrease in accuracy for resources located further than 300 m from the helicopter, as distances had to be rapidly estimated; however, all water resources were manually corrected when overlaid on aerial images.

Although the distinctive fresh bark of *Eucalyptus tintinnans* is easily identified (by its salmon pink colour), some trees still had older grey bark at the time of survey, and therefore may have been overlooked from a distance. As above, this would result in underestimating distribution and abundance of *E. tintinnans.*

Another potential source of error in aerial surveys is that *Corymbia latifolia* also has salmon pink new bark and is distinguished from *E. tintinnans* by the presence of rough red/brown bark on the lower trunk, this may have been difficult to confidently identify from high/faster transect flights. Where uncertainty regarding the tree species identified from the helicopter occurred, a second closer inspection was possible for the ROW east of KP35. However access to the survey area west of KP35 was limited to one flight pass and a second visit for validation was not possible. Therefore, there is greater uncertainty regarding habitat west of KP35.

In summary, when various sources of error are considered, field surveys are likely to provide a conservative estimate of the habitat and foraging resources available to Gouldian Finches. Identification of actual habitat being used by Gouldian Finches in the area is outside the scope of this study and will be confirmed during and following construction of the pipeline.

Figure 4-19: Aerial view of salmon coloured bark on *Eucalyptus tintinnans*

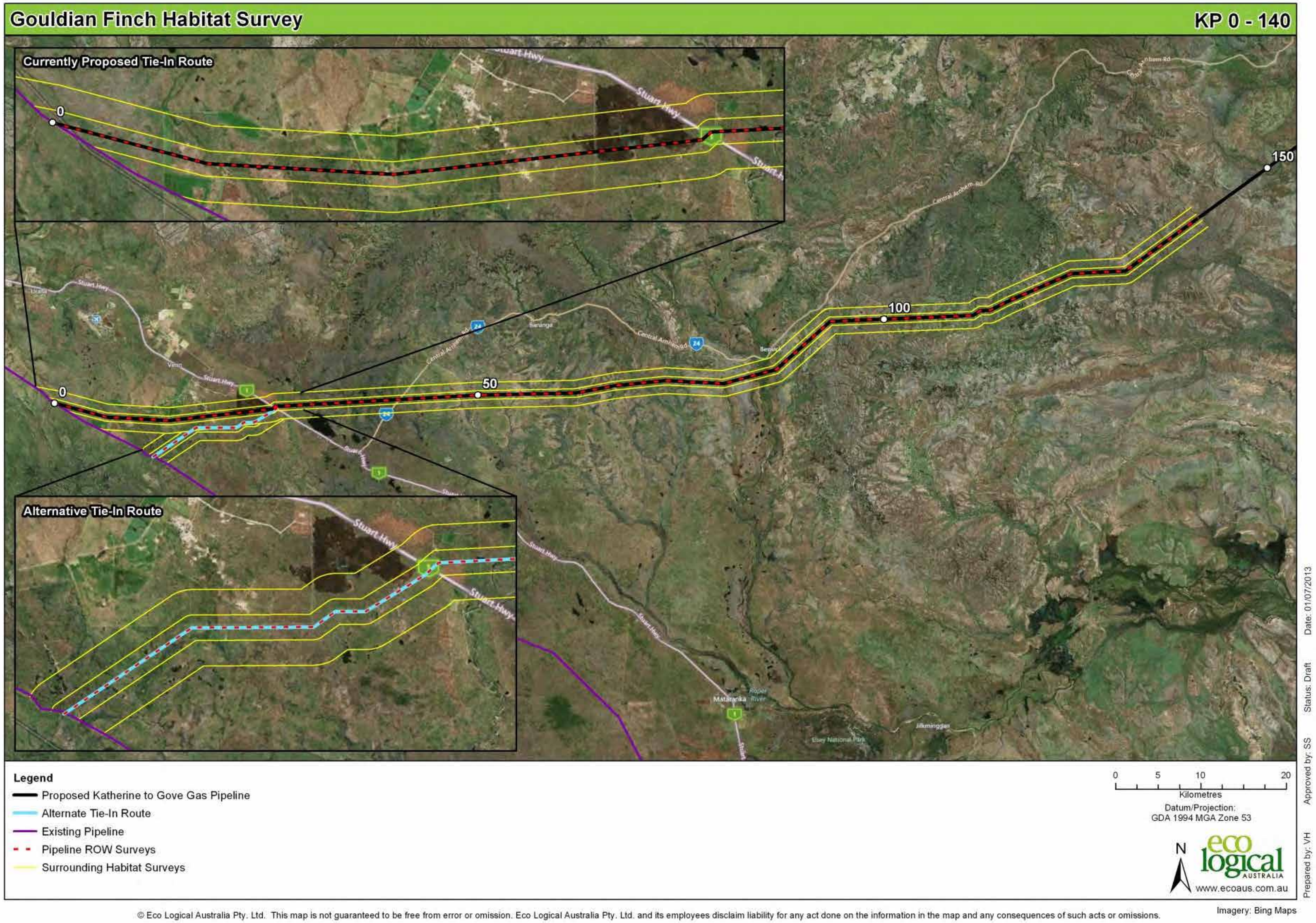


Figure 4-20: Gouldian Finch habitat survey transects along the pipeline centreline and in surrounding habitat

4.5.8 Results

Patches of Salmon Gums recorded

In total, 308 patches of Salmon Gums were recorded. The transect that ran directly over the pipeline centreline recorded a total of 119 patches of Salmon Gums along the 100 m wide survey area (equivalent to the pipeline corridor) including 90 patches of Salmon Gums within breeding (and coincident dry season foraging) habitat; meaning that they were within four kilometres of permanent water. Patches located further than four kilometres away from permanent water were defined as being outside breeding (and coincident dry season foraging) habitat. Of the 90 patches in breeding (and foraging) habitat, 80 were smaller than one hectare, and ten were between one to five hectares. Outside the pipeline corridor, but within two kilometres of the pipeline centreline, 189 patches of Salmon Gums were recorded, including 134 patches of Salmon Gums within breeding (and coincident dry season foraging) habitat. Of those patches, 60 were smaller than one hectare, 43 were between one to five hectares, and 31 were larger than five hectares (Table 4-11, Figure 4-21).

Areas of permanent water that were recorded during the survey and used to determine areas of breeding (and coincident dry season foraging) habitat comprised six perennial watercourses and 11 water features. The 11 water features included two wetlands, seven in-stream isolated remnant pools, one billabong, and one spring-fed waterhole (Table 4-12).

Table 4-11: Patches of Salmon Gums recorded within two kilometres of the KGGP centreline. Patches within four kilometres of permanent water were defined as being within breeding (and coincident dry season foraging) habitat.

AREA	WITHIN BREEDING (AND COINCIDENT DRY SEASON FORAGING) HABITAT				OUTSIDE BREEDING (AND COINCIDENT DRY SEASON FORAGING) HABITAT			
	<1 HA	1–5 HA	>5 HA	TOTAL	<1 HA	1–5 HA	>5 HA	TOTAL
Main pipeline corridor (excl tie-in)	80	10	-	**90**	10	-	-	**10**
Current tie-in corridor	-	-	-	**-**	8	9	-	**17**
Alternate tie-in corridor	-	-	-	**-**	1	1	-	**2**
Outside pipeline corridor	60	43	31	**134**	28	27	-	**55**
TOTAL	**140**	**53**	**31**	**224**	**47**	**37**	**-**	**84**

Delineation of areas of breeding (and coincident dry season foraging) habitat

The 308 patches of Salmon Gums recorded included 224 patches that were defined as being within breeding (and coincident dry season foraging) habitat (Table 4-11). Of these 224 patches, 84 were one hectare or larger and were used to delineate areas of breeding (and foraging) habitat. The remaining 140 patches were smaller than one hectare and were not considered when mapping habitat areas. This was due to their relatively small size and the scattered density of trees which are unlikely to support finch populations. To delineate the areas of breeding (and coincident dry season foraging) habitat containing the 84 patches one hectare or larger, an initial review was conducted of their spatial distribution. This review determined that the 84 patches formed five relatively distinct areas (Figure 4-22) and on this basis, five breeding (and coincident dry season foraging) habitat areas were defined within the survey area (Table 4-13).

The areas of breeding (and foraging) habitat defined ranged in size from 140 ha at KP34 to almost 6,000 ha at KP89-KP110. Salmon Gums in the western and central parts of the survey area occurred in flat lowland areas, while those in the eastern parts occurred on the tops of rocky rises.

Table 4-12: Watercourses and water features recorded along the pipeline corridor (within six kilometres of the KGGP centreline)

WATERCOURSE / WATER FEATURE	APPROXIMATE KP INTERSECT	NUMBER OF CROSSINGS
Watercourses		
King River	30	1
Roper Creek	35	1
Maranboy Creek	49	1
Beswick Creek	61 – 62	3
Waterhouse River	83 – 84	3
Chambers River	100 – 105	2
Water features		Distance from centreline (km)
Wetland	31	2.3
Wetland	36	1.4
Remnant pool	69	1.4
Remnant pool	70	0.5
Billabong	85	2.2
Remnant pool	96	3.1
Remnant pool	107	1.5
Spring-fed waterhole	118	0.2
Remnant pool	126	1.2
Remnant pool	128	1.5
Remnant pool	128	1.3

Table 4-13: Breeding (and coincident dry season foraging) habitat areas delineated within two kilometres of the KGGP centreline

LOCATION (KP)	AREA (HA)	WATER SOURCE WITHIN 4 KM	TOPOGRAPHY
34	140	Roper Creek	Flat lowland
56 - 71	4,664	Beswick Creek and two water features	Flat lowland
80	427	Waterhouse River	Flat lowland
89 - 110	5,929	Chambers River and tributaries	Rocky rises
116	951	Un-named spring	Rocky rises
TOTAL	12,111		

Estimated area of breeding (and coincident dry season foraging) habitat to be disturbed

Two methods were used to estimate the area of breeding (and coincident dry season foraging) habitat to be disturbed by establishment of the ROW. The first method provided a lower bound estimate and considered the 90 individual patches within four kilometres of permanent water that were recorded within the pipeline corridor (Table 4-11). Although one of the breeding (and coincident dry season foraging) habitat filters for resource mapping excluded patches smaller than one hectare, all patches were included when estimating the area of breeding (and foraging) habitat to be disturbed. The following assumptions apply to the use of this method:

- Patches are circular and centred on the pipeline centreline
- Patches less than one hectare in size were treated as one hectare
- Patches between one and five hectares in size were treated as three hectares
- The area of impact was calculated within the 30 m ROW

The size of the area of impact calculated in this way for the 90 individual patches (including 80 patches less than one hectare and 10 patches between one and five hectares) was 33 ha. This represents 0.27% of the 12,111 ha of total breeding (and coincident dry season foraging) habitat found within two kilometres of the pipeline centreline (refer Table 4-13).

The second method provided an upper bound estimate and considered the five breeding (and coincident dry season foraging) habitat areas delineated following the review of the spatial distribution of the 84 patches of Salmon Gums that were one hectare or larger and within four kilometres of permanent water. The area of impact was based on the area of the 30 m ROW measured through the five defined areas of breeding (and coincident dry season foraging) habitat (as per Figure 4-22). The size of the area of impact calculated in this way was 101 ha. This represents 0.83% of the 12,111 ha of total breeding (and coincident dry season foraging) habitat within two kilometres of the pipeline centreline.

Estimated number of trees to be disturbed

A very rough estimate of the number of Salmon Gums in breeding (and coincident dry season foraging) habitat that may be disturbed by the project was calculated using the 90 patches of Salmon Gums recorded in breeding (and coincident dry season foraging) habitat within the pipeline corridor. These 90 patches included 80 patches less than one hectare and ten patches between one and five hectares in size (refer to Table 4-11). The following assumptions apply to the use of this method:

- The density of Salmon Gums within each patch is five per hectare
- Patches less than one hectare in size were treated as one hectare patches (and therefore each contains five Salmon Gums)
- Patches between one and five hectares in size were treated as three hectares (and therefore each contains 15 Salmon Gums)
- Salmon Gums were evenly distributed within the 100 m pipeline corridor and the area of impact was calculated within the 30 m ROW (representing 30% of the 100 m pipeline corridor).

The number of Salmon Gums estimated in this way to occur within the 100 m pipeline corridor was 550. Of these, the number estimated to occur within the 30 m ROW was 165. Therefore, approximately 165 Salmon Gums within defined breeding (and coincident dry season foraging) habitat areas may be cleared by construction to establish the ROW.

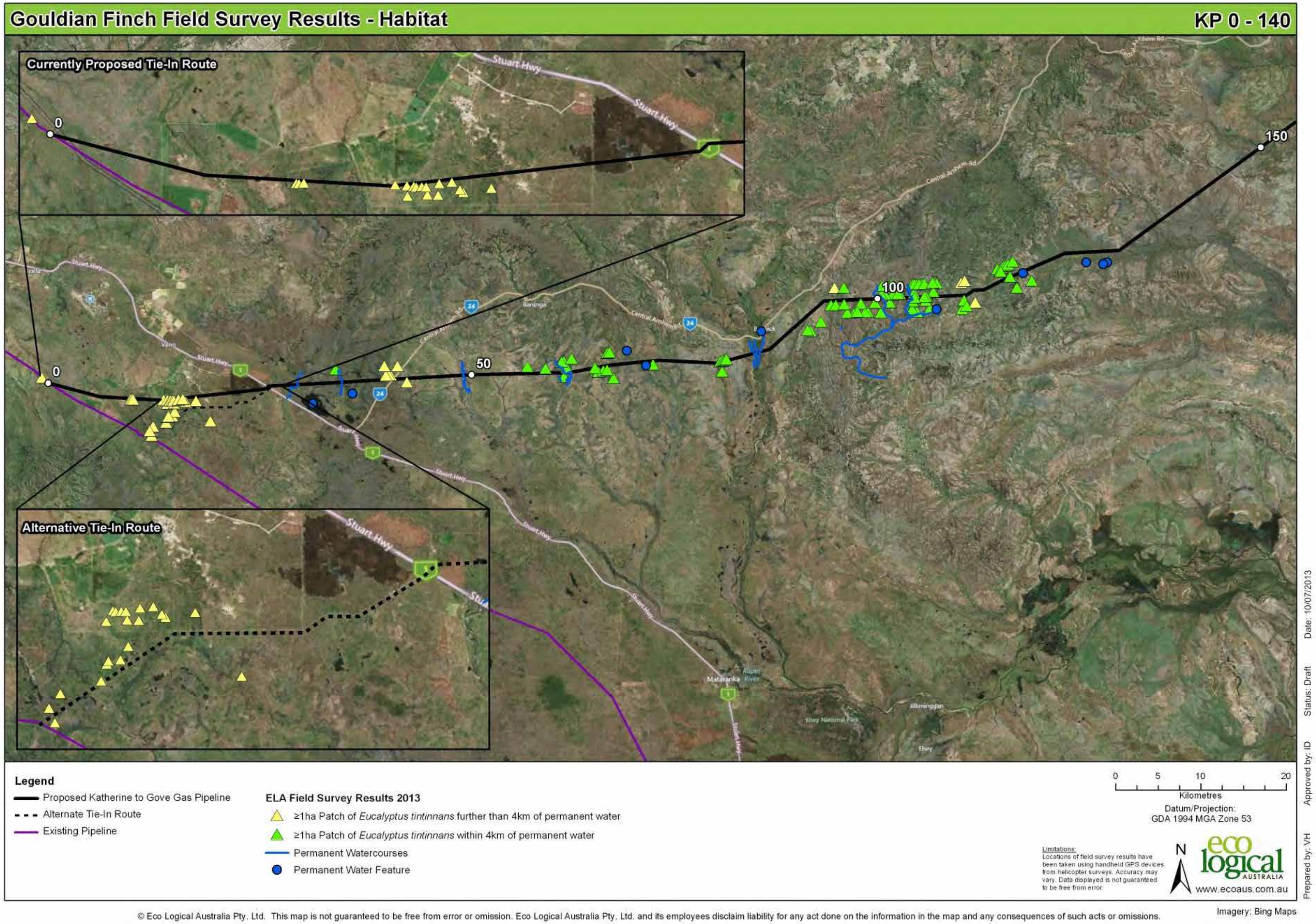


Figure 4-21: *Eucalyptus tintinnans* (Salmon Gum) patches (greater than one hectare in size) and watercourses and water features between KP1-KP140

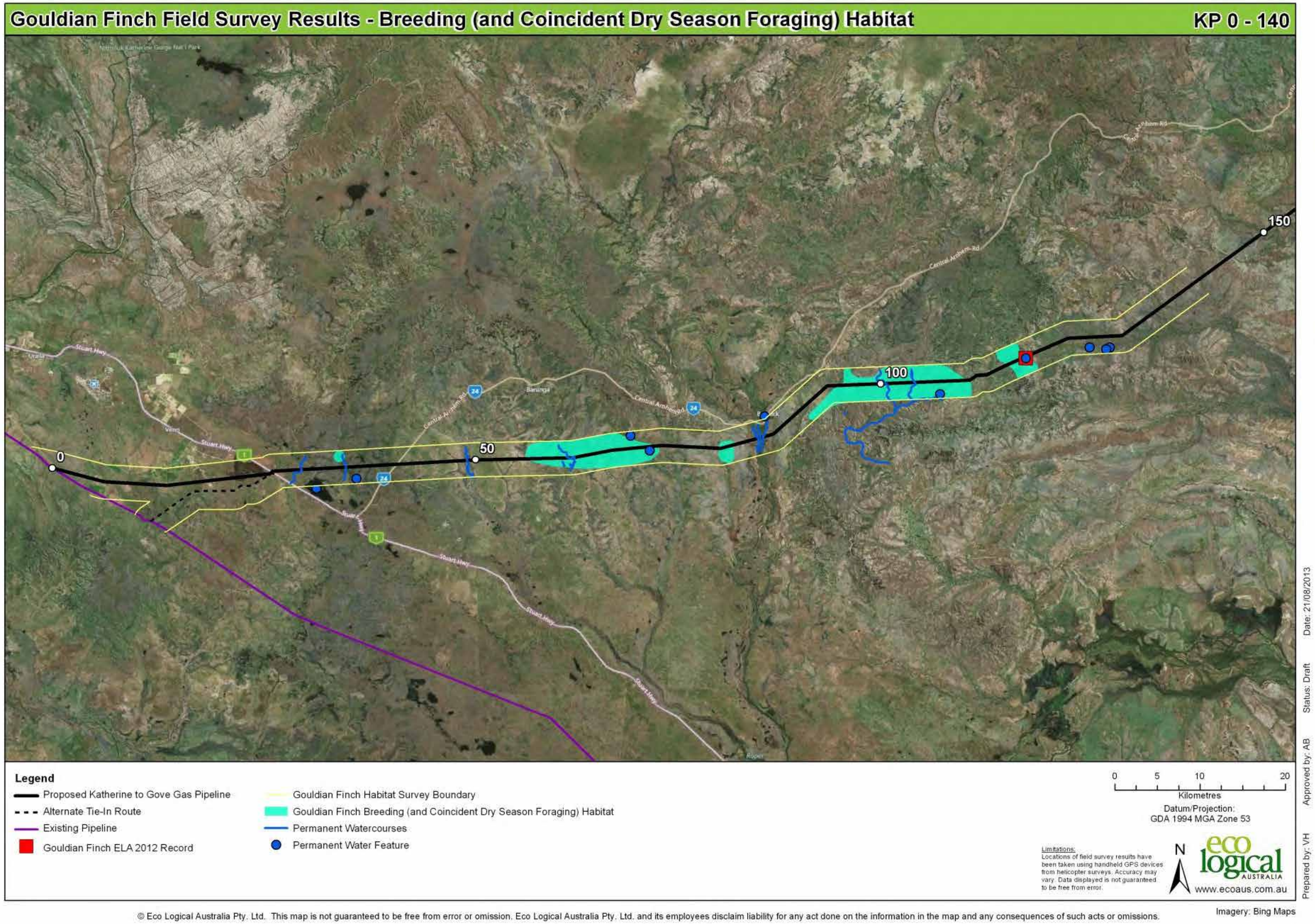
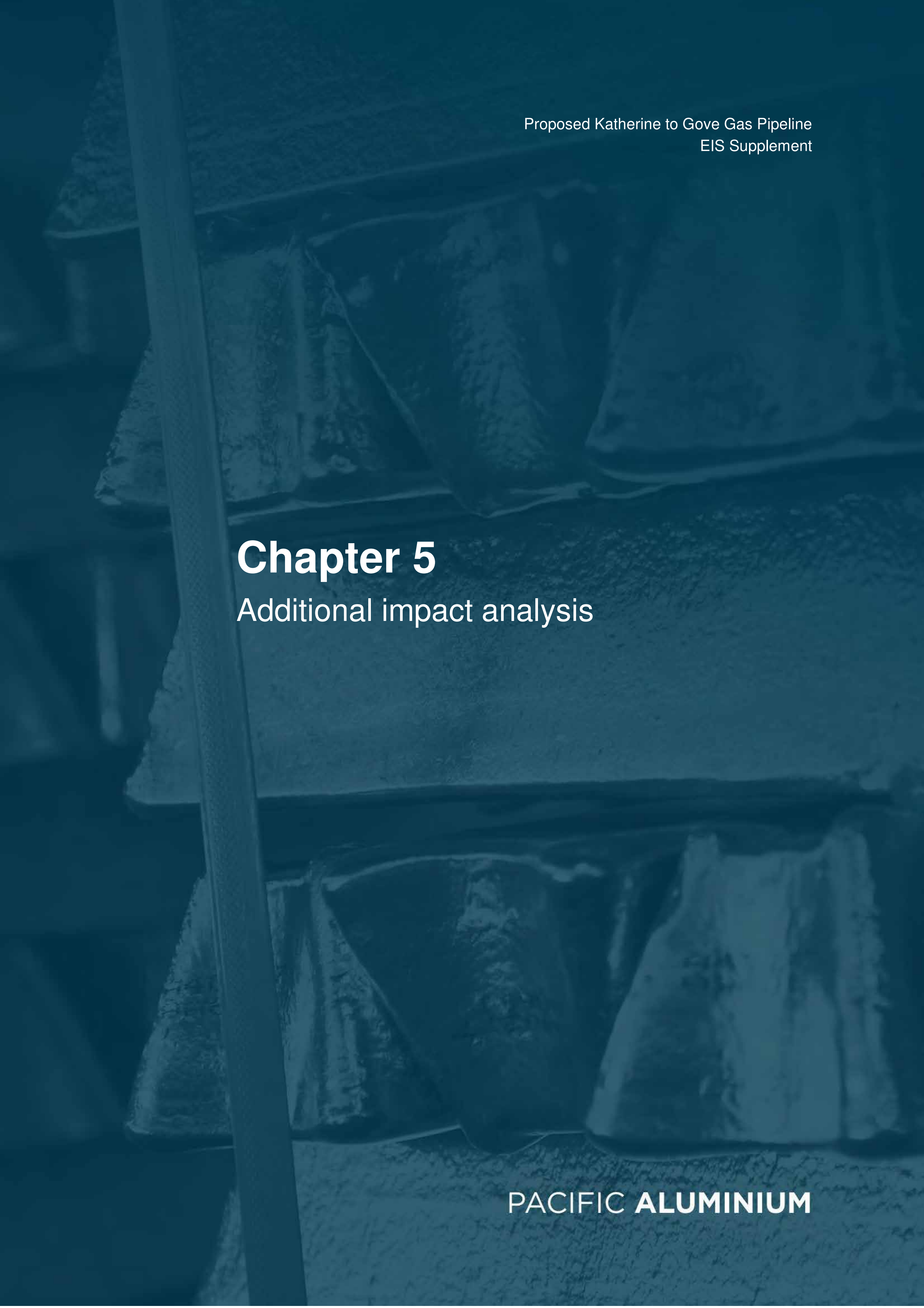


Figure 4-22: Gouldian Finch breeding (and coincident dry season foraging) habitat regions

Figure 4-23: *Eucalyptus tintinnans* on a rocky hill slope (upper photo) and flat lowland (lower photo)

PACIFIC **ALUMINIUM**



Chapter 5

Additional impact analysis

PACIFIC ALUMINIUM

Contents

5 Additional impact analysis

This Chapter updates the relevant conclusions reached on potential and likely residual impacts in the Draft EIS using information presented in Chapter 4 and additional analysis, particularly regarding a number of Matters of NES species of concern. The information presented should be read in conjunction with the relevant impact Chapters of the Draft EIS (particularly Chapters 8, 9 and 10).

5.1 VEGETATION COMMUNITIES

5.1.1 Existing alignment (as detailed in the Draft EIS)

Vegetation mapping analysis for the proposed KGGP alignment (based on detailed vegetation mapping described in section 4.1) is presented in Table 5-1. The updated analysis indicates that 1808 ha would be cleared through construction of the ROW, not including clearing required for access tracks and other associated infrastructure. *Eucalyptus* woodlands would be most affected by clearing for the ROW (592 ha, 33% of ROW), followed by *Eucalyptus* open forest (374 ha, 21% of ROW) and *Eucalyptus* open woodland (171 ha, 9% of ROW). These vegetation communities are also common within the area one kilometre either side of the pipeline centreline. With the exception of one vegetation community, proposed clearing to establish the ROW would result in the loss of less than 3% of the vegetation communities compared to their distribution in the area one kilometre either side of the pipeline centreline. The exception is *Erythrophleum* variable open woodland which is estimated to occupy 26 ha in the region one kilometre either side of the pipeline centreline, of which 2 ha (6%) are proposed to be cleared.

The vegetation mapping analysis confirms that no mangroves (*Avicennia*, *Ceriops* or *Rhizophora* closed forests), no rainforests (vine forest, vine thicket) and no sandstone shrubland would be cleared along the ROW as proposed.

Table 5-1: Clearing calculations of the ROW based on vegetation mapping by ELA 2013

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	EXTENT OF VEGETATION COMMUNITY (ha) 1 KM EITHER SIDE OF PIPELINE	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% OF VEGETATION UNIT IN WIDER REGION (1 KM EITHER SIDE OF PIPELINE) TO BE CLEARED	% TO BE CLEARED WITHIN 30 M ROW
Acacia and *Grevillea* low woodland	65	<1	<1	<1
Acacia closed forest	287	2	1	<1
Acacia forest	142	3	2	<1
Acacia open forest	118	1	<1	<1
Acacia open woodland	222	1	1	<1
Acacia woodland	519	6	1	<1
Aristida grassland	1073	14	1	1
Avicennia closed forest	2	0	0	0
Beach	25	0	0	0
Callitris tall woodland	24	0	0	0

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	EXTENT OF VEGETATION COMMUNITY (ha) 1 KM EITHER SIDE OF PIPELINE	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% OF VEGETATION UNIT IN WIDER REGION (1 KM EITHER SIDE OF PIPELINE) TO BE CLEARED	% TO BE CLEARED WITHIN 30 M ROW
Canarium (mixed) closed forest	61	1	1	<1
Casuarina closed forest	92	2	2	<1
Casuarina woodland	18	0	0	0
Ceriops low closed forest	50	0	0	0
Corymbia forest	188	4	2	<1
Corymbia low open forest	751	17	2	1
Corymbia low open woodland	636	7	1	<1
Corymbia low woodland	154	3	2	<1
Corymbia open forest	2207	36	2	2
Corymbia open woodland	3622	51	1	3
Corymbia tall open woodland	4	0	0	0
Corymbia woodland	4458	68	2	4
Eriachne grassland	278	4	1	<1
Erythrophleum low open woodland	52	1	2	<1
Erythrophleum variable open woodland	26	2	6	<1
Eucalyptus closed forest	1607	23	2	1
Eucalyptus forest	887	11	1	1
Eucalyptus low forest	15	0	0	0
Eucalyptus low open forest	569	5	1	<1
Eucalyptus low open woodland	1192	25	2	1
Eucalyptus low woodland	7284	116	2	6
Eucalyptus open forest	24657	374	2	21
Eucalyptus open woodland	11280	171	2	9
Eucalyptus tall open forest	665	12	2	1
Eucalyptus tall woodland	57	<1	<1	<1
Eucalyptus woodland	38930	592	2	33
Halosarcia low sparse samphire shrubland	105	<1	1	<1
Heteropogon grassland	292	4	1	<1
Heteropogon open grassland	139	3	2	<1
Lophostemon closed forest	334	3	1	<1
Lophostemon open forest	79	1	2	<1
Lophostemon open woodland	61	1	1	<1
Lophostemon woodland	42	1	1	<1
Melaleuca closed forest	1144	17	2	1

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	EXTENT OF VEGETATION COMMUNITY (ha) 1 KM EITHER SIDE OF PIPELINE	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% OF VEGETATION UNIT IN WIDER REGION (1 KM EITHER SIDE OF PIPELINE) TO BE CLEARED	% TO BE CLEARED WITHIN 30 M ROW
Melaleuca forest	89	2	3	<1
Melaleuca low open forest	130	<1	<1	<1
Melaleuca low open woodland	378	3	1	<1
Melaleuca low woodland	722	14	2	1
Melaleuca open forest	3044	45	2	3
Melaleuca open woodland	1459	28	2	2
Melaleuca tall forest	66	1	1	<1
Melaleuca tall open forest	122	2	2	<1
Melaleuca tall open woodland	7	<1	1	0
Melaleuca woodland	5662	78	1	4
Mixed species open woodland	131	<1	<1	<1
Mixed tussock grassland/sedgeland	27	0	0	0
Pastoral / Horticultural / Roads / Developed	2836	40	1	2
Petalostigma pubescens low woodland	566	10	2	1
Platyzoma swamp	38	1	2	<1
Rhizophora closed forest	23	0	0	0
Sandstone shrubland	44	0	0	0
Sparse shrubland	3	0	0	0
Tussock grassland	469	5	1	<1
Vine forest	17	0	0	0
Vine thicket	11	0	0	0

The results of the vegetation mapping analysis confirm the conclusions presented in the Draft EIS regarding vegetation communities impacted by clearing vegetation for the ROW. *Eucalyptus* woodlands, *Eucalyptus* open forest and *Eucalyptus* open woodland would be the dominant vegetation communities affected by clearing and are widespread in the region. As a result of the low percentage loss of vegetation communities in their regional context, and mitigation measures put forward in the Draft EIS (Appendix O), potential impacts on vegetation are expected to be negligible to low and therefore considered not significant.

5.1.2 Alternative tie-in alignment

An alternative tie-in alignment for the KGGP was proposed in the Draft EIS (Figure 2-2). Under this option the KGGP would tie in to the NT Amadeus Gas Pipeline 13 km south of the first option and take a more southerly route until crossing the Stuart Highway. This option would reduce the pipeline length and temporary disturbance of land.

The vegetation communities of the alternate tie-in corridor (inclusive of a one kilometre buffer zone on either side) were mapped using the methodologies described in section 4.1 and shown at Figure 5-1. A more detailed digital copy can be obtained from the NT EPA.

Vegetation mapping analysis is presented in Table 5-2. The analysis indicates that approximately 50 ha would be cleared through construction of the alternative ROW (not including clearing required for access tracks and other associated infrastructure). The dominant vegetation community affected by clearing for the alternative ROW would be non-native vegetation associated with developed lands (Pastoral-Horticultural-Roads-Developed)*:* 20 ha or 41% of the alternative ROW. *Eucalyptus* woodland (8 ha, 17% of alternative ROW) would be the dominant native vegetation community to be removed through clearing activities. All other vegetation communities within the proposed alternative ROW would require clearing of less than 6 ha each.

These vegetation communities are common within the region one kilometre either side of the pipeline centreline. All native vegetation communities are affected less than 3% by the proposed clearing for the alternative ROW, when compared to their distribution in the region one kilometre either side of the pipeline centreline.

The analysis of the alternative ROW alignment confirms that no sensitive communities (e.g. vine forest, vine thicket, sandstone shrubland) would be cleared to establish the ROW for the alternative tie-in. The conclusions of the Draft EIS in respect of a negligible to low impacts on vegetation communities (following mitigation) from clearing of native vegetation for the ROW would therefore not be altered, by implementation of the alternative tie-in alignment.

Table 5-2: Alternative tie-in alignment - clearing calculations based on vegetation mapping by ELA 2013

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	EXTENT OF VEGETATION COMMUNITY (HA) 1 KM EITHER SIDE OF PIPELINE	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% OF VEGETATION UNIT IN WIDER REGION (1 KM EITHER SIDE OF PIPELINE) TO BE CLEARED	% TO BE CLEARED WITHIN 30 M ROW
Acacia closed forest	39	<1	<1	<1
Corymbia forest	13	<1	3	1
Corymbia open woodland	461	5	1	11
Eucalyptus low open woodland	25	0	0	0
Eucalyptus open forest	871	5	1	11
Eucalyptus open woodland	526	5	1	10
Eucalyptus woodland	906	8	1	17
Pastoral / Horticultural / Roads / Developed	499	20	4	41
Petalostigma pubescens low woodland	276	4	2	9

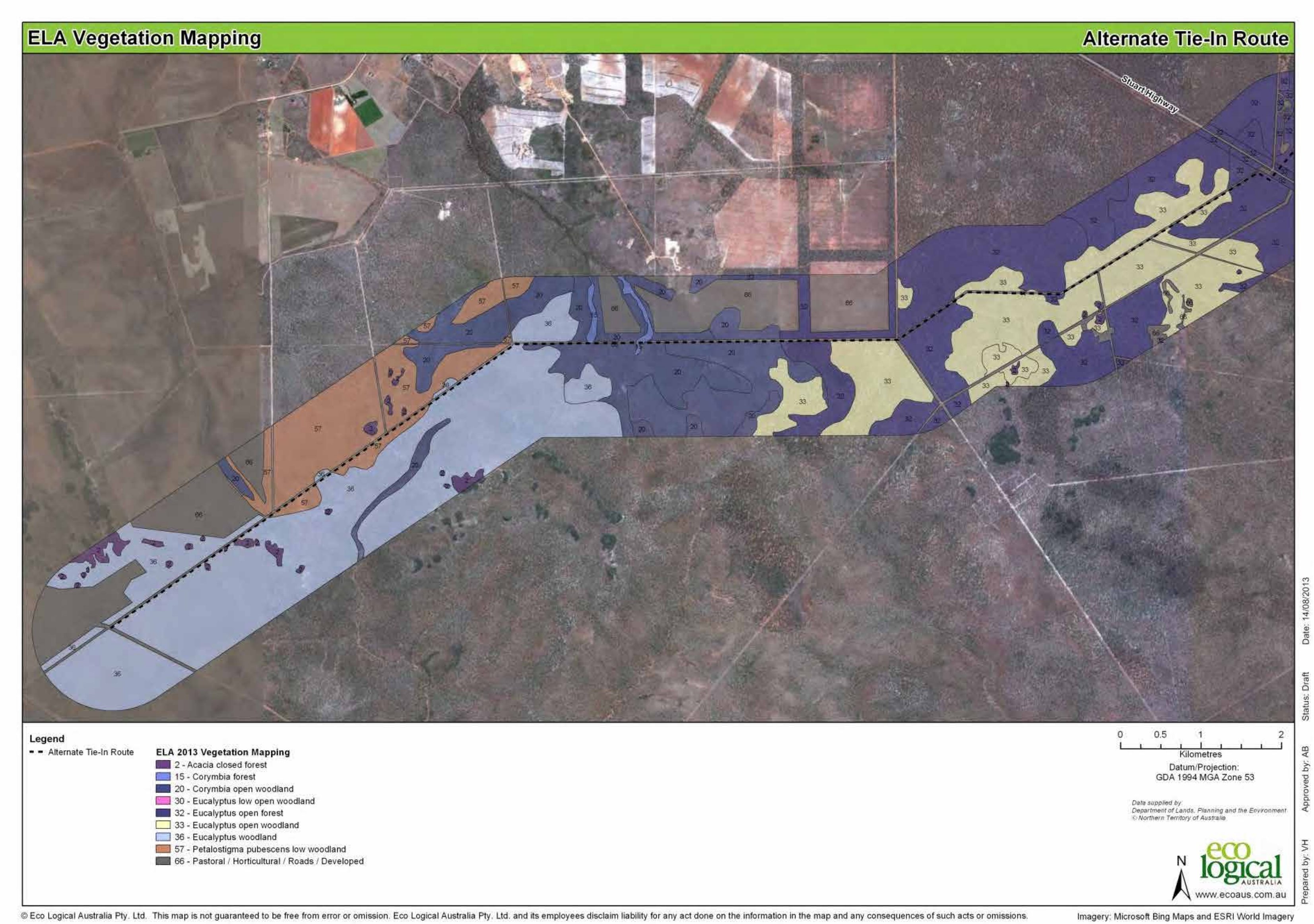


Figure 5-1: Alternate tie-in alignment for the KGGP ROW and vegetation mapping

5.1.3 Mitchell Ranges alternative alignment (KP393-466.5)

The vegetation communities of the possible alternative alignment in the Mitchell Ranges region (inclusive of a one kilometre buffer zone on either side) were mapped using the methodologies described in section 4.1 and shown at Figures 5-2 to 5-5. A more detailed digital copy can be obtained from the NT EPA.

Vegetation mapping analysis is presented in Table 5-3. The analysis indicates that approximately 208 ha of native vegetation would be cleared through construction of the alternative ROW. The dominant vegetation communities affected by clearing for the alternative ROW would be *Eucalyptus* open forest and *Eucalyptus* woodland, each comprising 26% of the ROW.

The identified vegetation communities are common within the wider region. All vegetation communities are affected less than 4% by the proposed clearing for the alternative ROW, when compared to their distribution in the region one kilometre either side of the pipeline centreline.

The analysis of the alternative ROW alignment confirms that no sensitive communities vine forest or vine thicket vegetation communities would be cleared to establish the ROW for the Mitchell Ranges alternative alignment. The conclusions of the Draft EIS in respect of a negligible to low impacts on vegetation communities (following mitigation) from clearing of native vegetation for the ROW would therefore not be altered, by implementation of the alternative alignment.

Table 5-3: Alternative alignment Mitchell Ranges - clearing calculations based on vegetation mapping by ELA 2013

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	EXTENT OF VEGETATION COMMUNITY (ha) 1 KM EITHER SIDE OF PIPELINE	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% OF VEGETATION UNIT IN WIDER REGION (1 KM EITHER SIDE OF PIPELINE) TO BE CLEARED	% TO BE CLEARED WITHIN 30 M ROW
Corymbia low open forest	2	0	0	0
Corymbia low open woodland	11	0	0	0
Corymbia low woodland	10	<1	<1	<1
Corymbia open forest	7	0	0	0
Eucalyptus forest	438	8	2	4
Eucalyptus low open forest	1165	15	1	7
Eucalyptus low open woodland	1054	24	2	12
Eucalyptus low woodland	1276	11	1	6
Eucalyptus open forest	4091	54	1	26
Eucalyptus open woodland	839	17	2	8
Eucalyptus woodland	3895	55	1	26
Low open woodland	15	0	0	0
Melaleuca closed forest	3	0	0	0
Melaleuca forest	255	5	2	2
Melaleuca low open forest	79	1	1	1
Melaleuca low woodland	28	1	4	1
Melaleuca open forest	273	3	1	2

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	EXTENT OF VEGETATION COMMUNITY (ha) 1 KM EITHER SIDE OF PIPELINE	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% OF VEGETATION UNIT IN WIDER REGION (1 KM EITHER SIDE OF PIPELINE) TO BE CLEARED	% TO BE CLEARED WITHIN 30 M ROW
Corymbia low open forest	2	0	0	0
Melaleuca open woodland	16	<1	<1	<1
Melaleuca tall forest	156	2	1	1
Melaleuca woodland	421	8	2	4
Pastoral / Horticultural / Roads / Developed	3	<1	<1	<1
Platyzoma swamp	23	<1	<1	<1
Tussock grassland	65	2	3	1
Total				

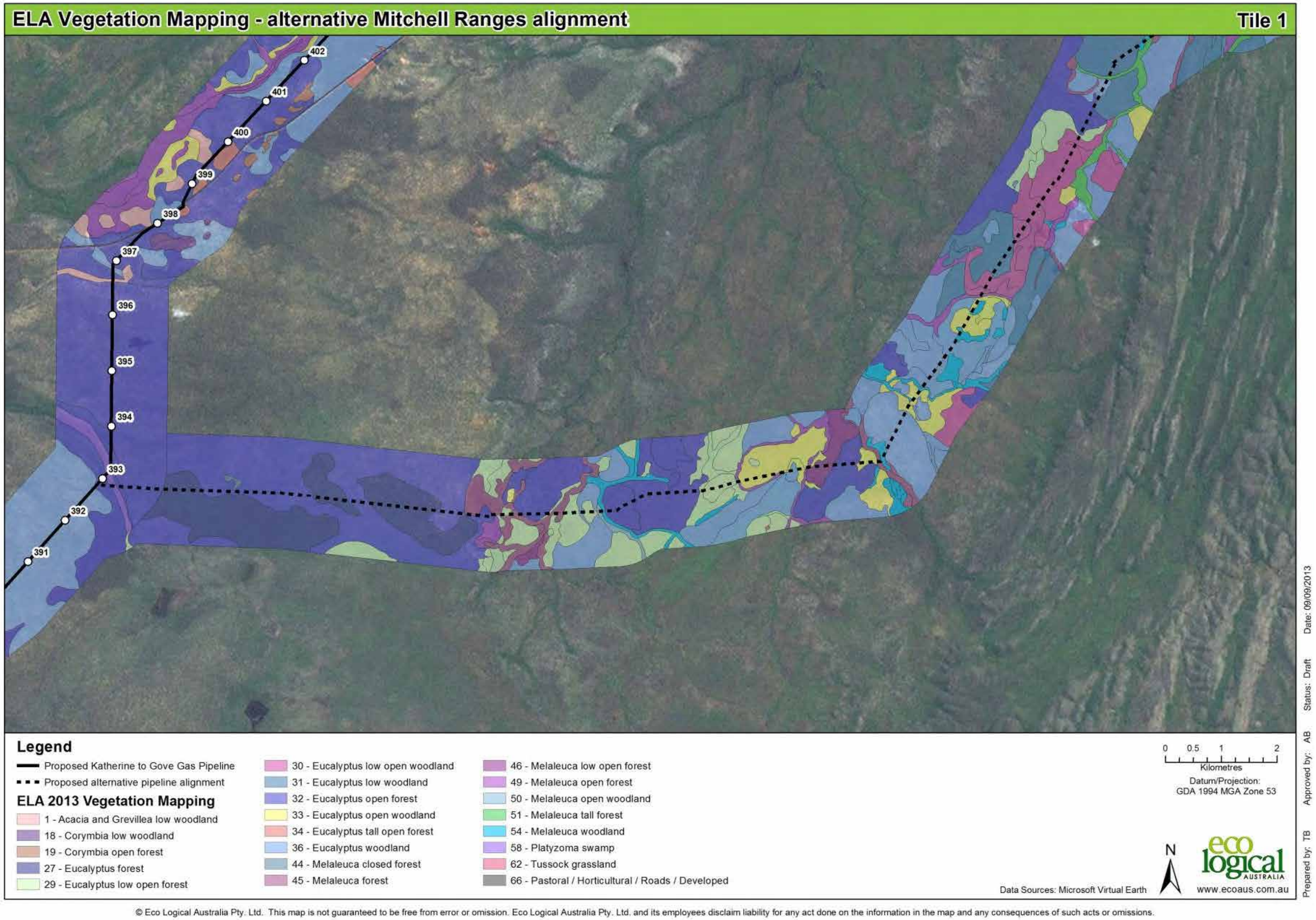


Figure 5-2: Alternative ROW alignment Mitchell Ranges and vegetation mapping – western section

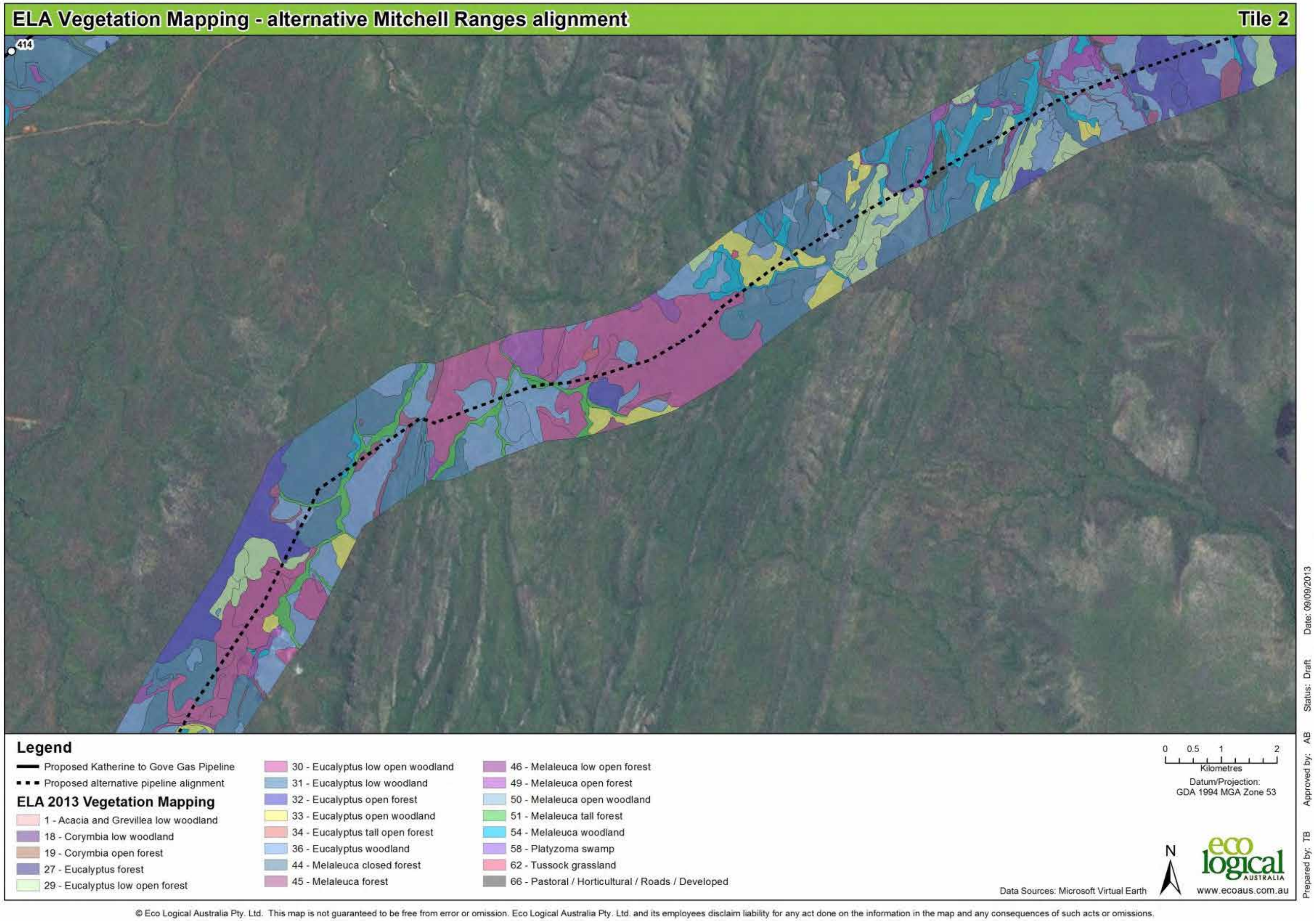


Figure 5-3: Alternative ROW alignment Mitchell Ranges and vegetation mapping – middle section (western)

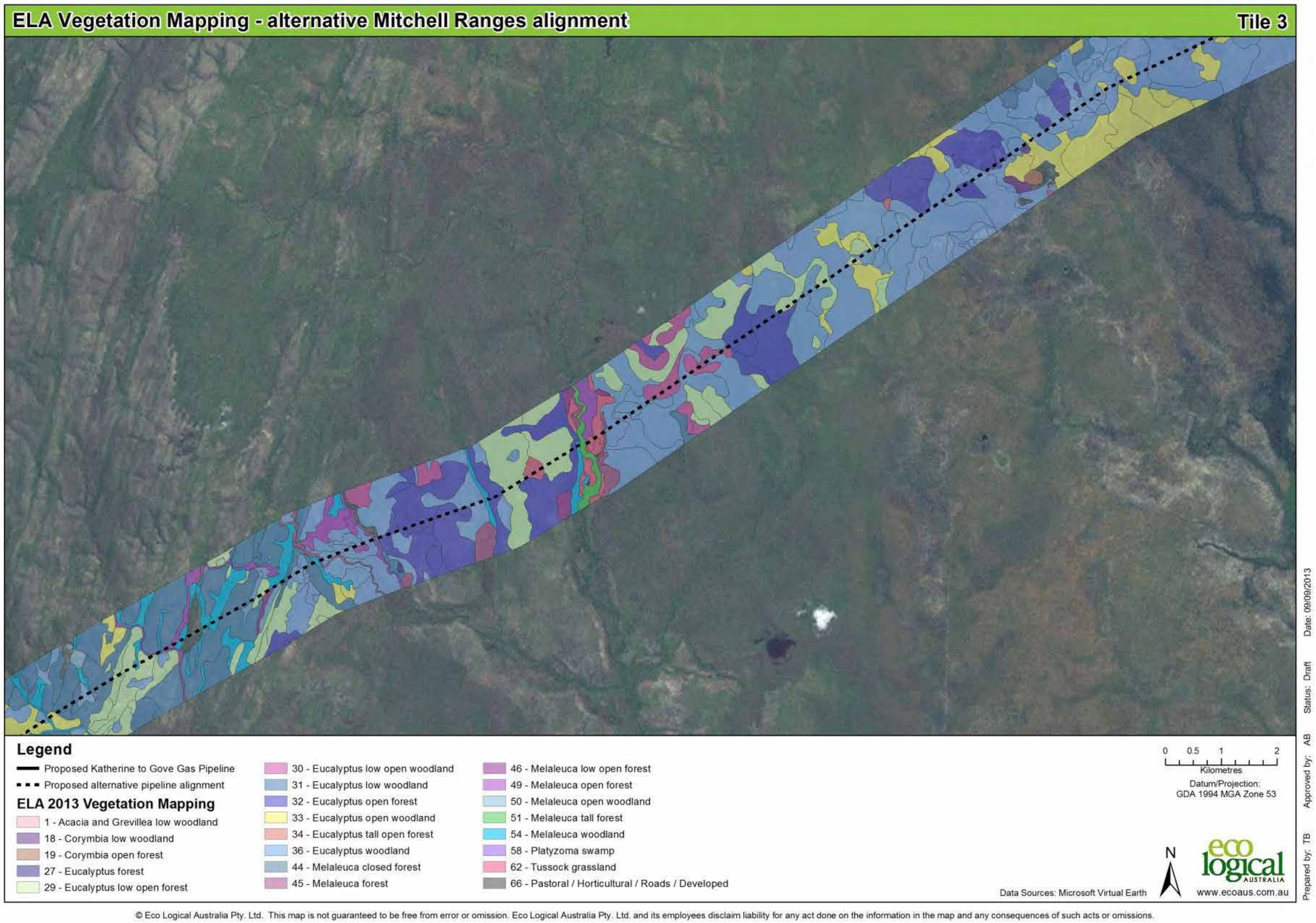


Figure 5-4: Alternative ROW alignment Mitchell Ranges and vegetation mapping – middle section (eastern)

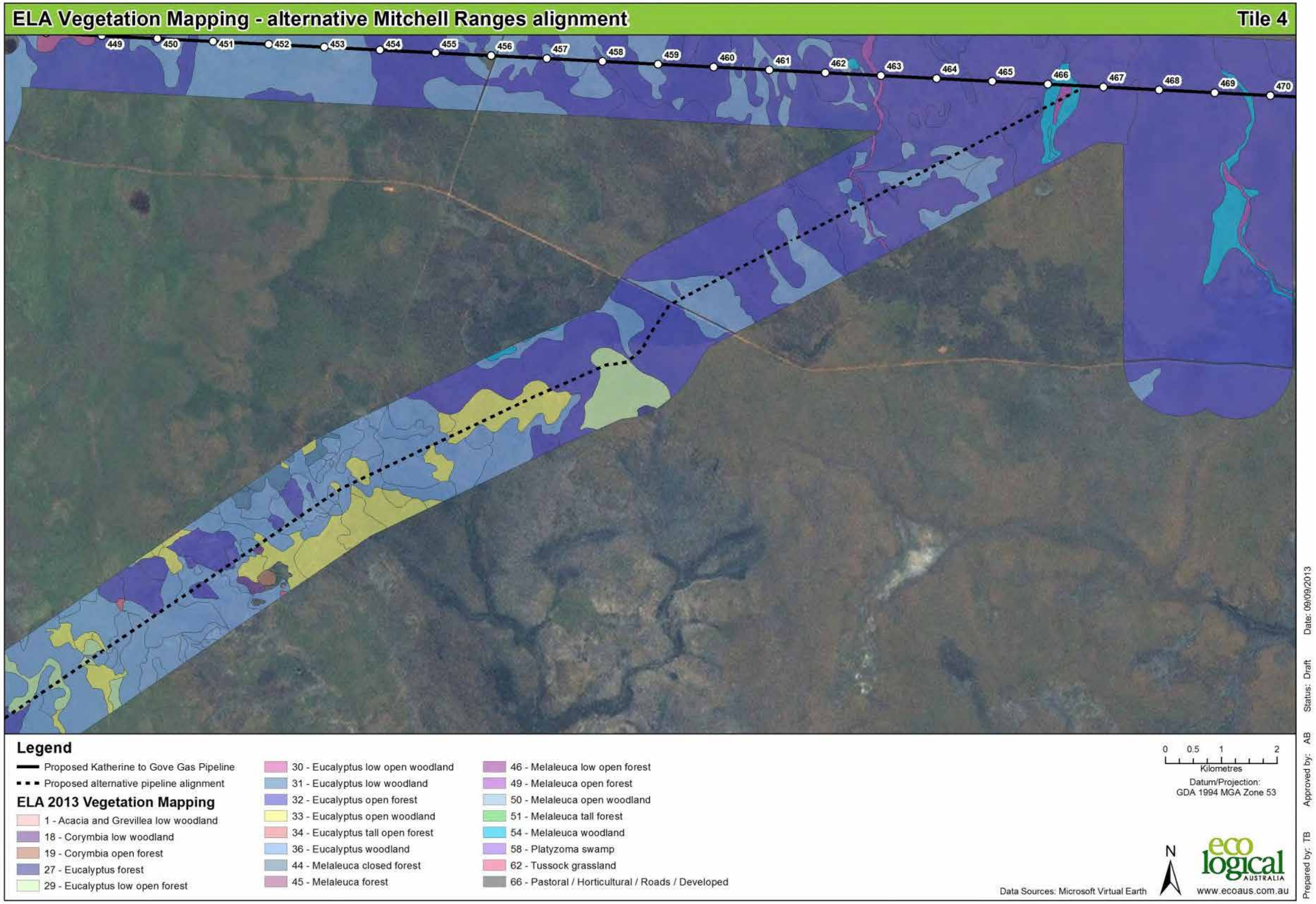


Figure 5-5: Alternative ROW alignment Mitchell Ranges and vegetation mapping – eastern section

5.1.4 Boggy Creek alternative alignment (KP505-519)

The vegetation communities of the possible small deviation at Boggy Creek (inclusive of a one kilometre buffer zone on either side) were mapped using the methodologies described in section 4.1 and shown at Figure 5-6. A more detailed digital copy can be obtained from the NT EPA.

Vegetation mapping analysis is presented in Table 5-4. The analysis indicates that approximately 39 ha would be cleared through construction of the alternative ROW. The dominant vegetation community affected by clearing for the alternative ROW would be *Eucalyptus* woodland.

The identified vegetation communities are common within the wider region. No additional vegetation communities are affected by the alternative alignment compared with that originally proposed in the Draft EIS. The alternative alignment would however, avoid sections of *Corymbia* open woodland and *Lophostemon* closed forest that would be affected by clearing for the ROW alignment as originally proposed in the Draft EIS.

The analysis of the alternative ROW alignment confirms that no sensitive communities (e.g. vine forest, vine thicket, sandstone shrubland) would be cleared to establish the ROW for the alternative. The conclusions of the Draft EIS regarding negligible to low impacts on vegetation communities (following mitigation) from clearing of native vegetation for the ROW would therefore not be altered, by implementation of the alternative alignment.

Table 5-4: Boggy Creek alternative alignment (KP505-519) - clearing calculations based on vegetation mapping by ELA 2013

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	AREA (ha) TO BE CLEARED WITHIN 30 M ROW
Eucalyptus low open woodland	2
Eucalyptus open forest	3
Eucalyptus open woodland	11
Eucalyptus woodland	18
Melaleuca closed forest	1.
Melaleuca open forest	3
Melaleuca open woodland	1

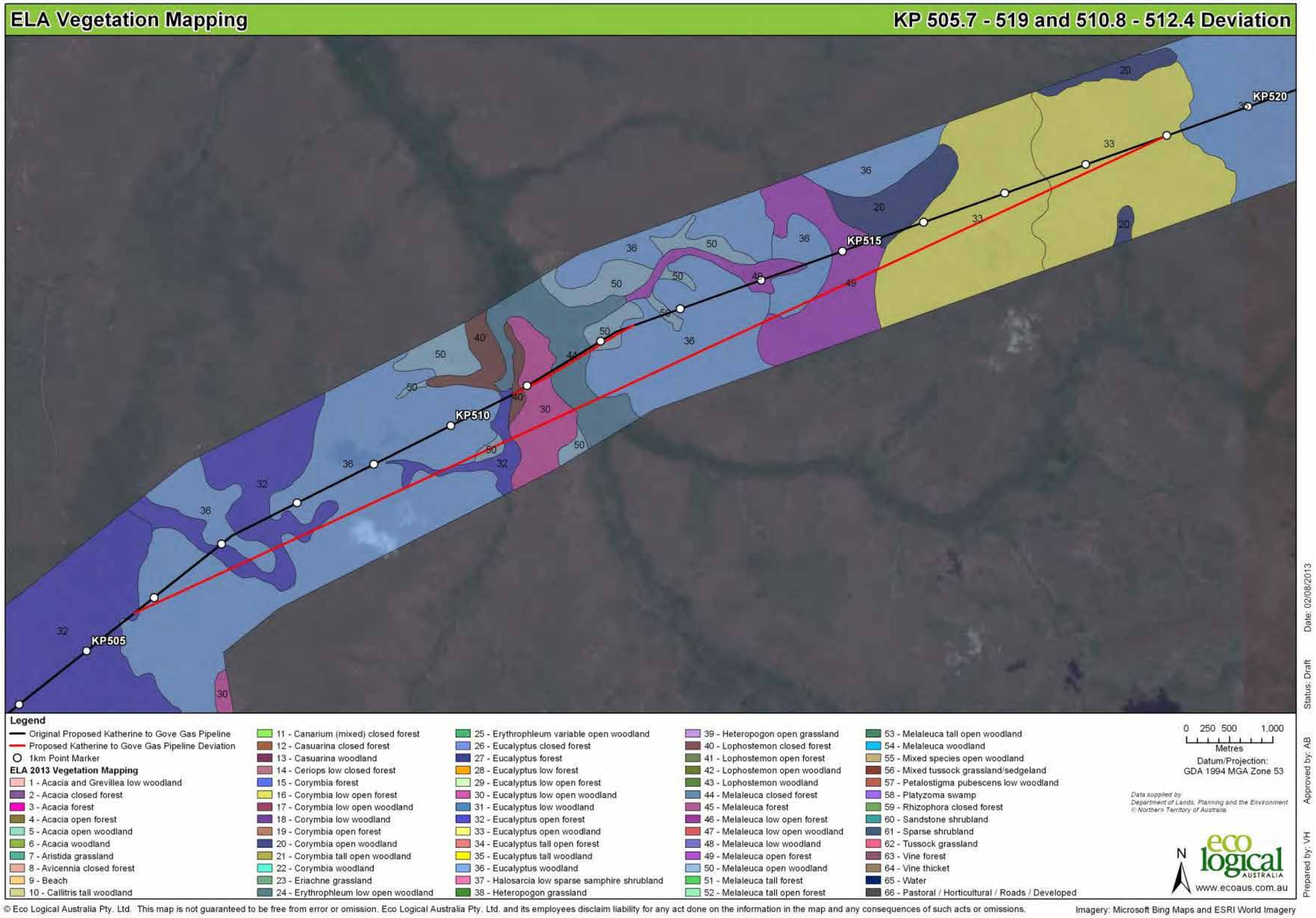


Figure 5-6: Boggy Creek alternative alignment between KP505-519 and vegetation mapping

5.1.5 Realignment around Mining Lease MLN955 (KP581-588)

The vegetation communities of the possible small deviation north of the Latram River (inclusive of a one kilometre buffer zone on either side) were mapped using the methodologies described in section 4.1 and shown at Figure 5-7. A more detailed digital copy can be obtained from the NT EPA.

Vegetation mapping analysis is presented in Table 5-5. The analysis indicates that approximately 18 ha would be cleared through construction of the alternative ROW. The dominant vegetation community affected by clearing for the alternative ROW would be *Eucalyptus* open woodland.

The identified vegetation communities are common within the wider region. No additional vegetation communities are affected by the alternative alignment compared with that originally proposed in the Draft EIS.

The analysis of the alternative ROW alignment confirms that no sensitive communities (e.g. vine forest, vine thicket, sandstone shrubland) would be cleared to establish the ROW for the alternative alignment. The conclusions of the Draft EIS regarding a negligible to low impacts on vegetation communities (following mitigation) from clearing of native vegetation for the ROW would therefore not be altered, by implementation of the alternative alignment.

Table 5-5: Alternative alignment around mining lease MLN955 (KP581-588) - clearing calculations based on vegetation mapping by ELA 2013

VEGETATION MAPPING BY ELA 2013 (NVIS LEVEL 3)	AREA (ha) TO BE CLEARED WITHIN 30 M ROW
Corymbia open forest	4
Eucalyptus low open forest	4
Eucalyptus open forest	3
Eucalyptus open woodland	5
Eucalyptus woodland	1
Melaleuca open forest	1

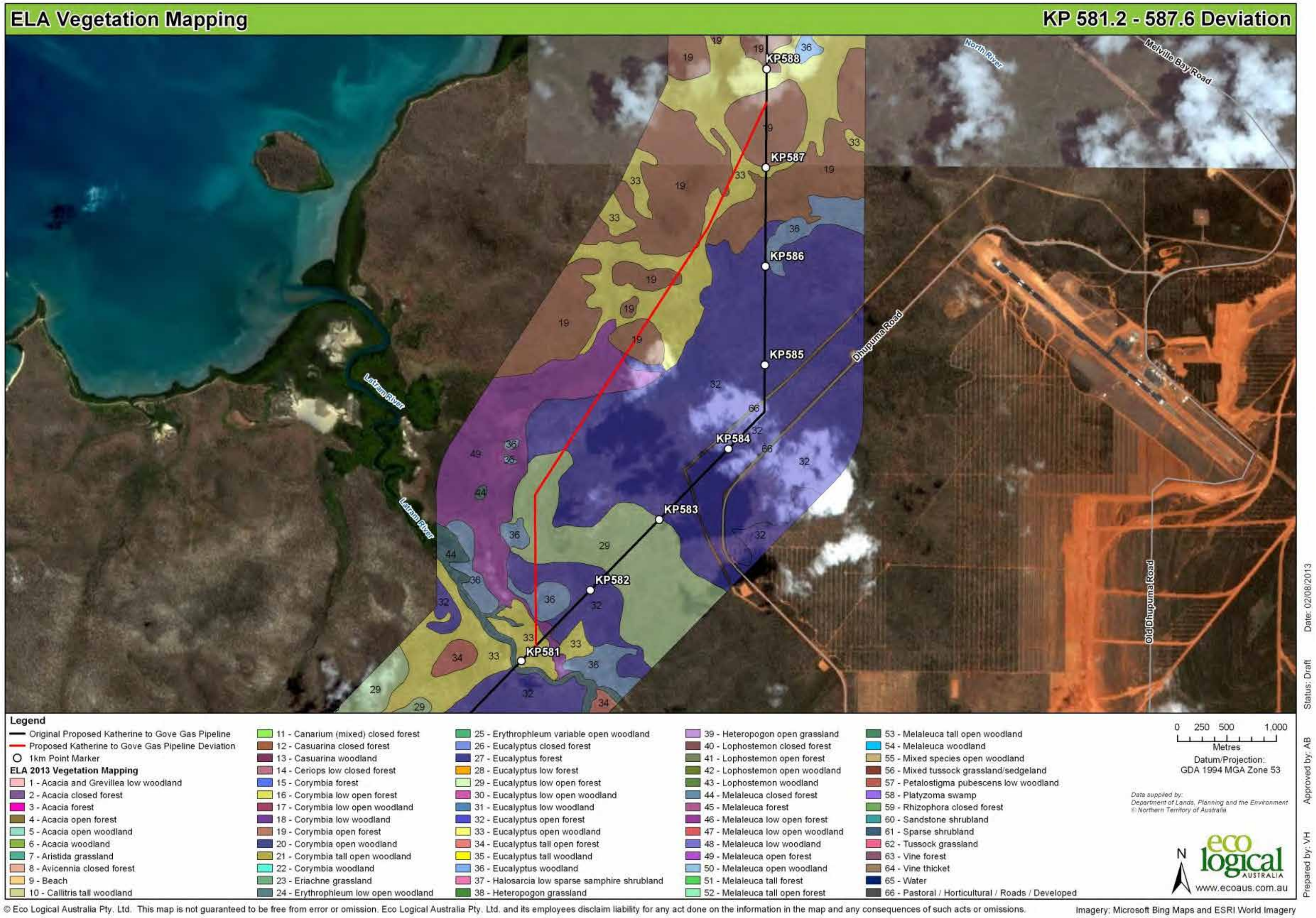


Figure 5-7: Alternative alignment around MLN955 between KP581-588 and vegetation mapping

5.2 THREATENED FLORA SPECIES: ADDITIONAL RECORDS

5.2.1 Introduction

The Draft EIS identified threatened flora species that might occur in the project area. A protected matters search and a search of a number of other databases (e.g. NT Herbarium Database and Atlas of Living Australia) for threatened species listed under the EPBC Act and the TPWC Act identified only five flora species with possible or likely occurrence in the project area:

- Arenga Palm (*Arenga australasica*) – misidentified taxon in the NT.
- *Cycas armstrongii* - considered to most likely be an incorrect record, outside normal distribution range.
- *Hernandia nymphaeifolia* (Vulnerable, NT listed only).
- *Pternandra coerulescens* (Vulnerable, NT listed only).
- *Sticherus flabellatus* var. *compactus* (Vulnerable, NT listed only).

The Draft EIS explained why only one of these species, *P. coerulescens*, had a reasonable likelihood of occurring in the pipeline corridor. The distribution of this species may have changed since the 2003-04 flora survey of the pipeline corridor and the species was therefore the subject of a targeted search in May 2013 and the results presented Chapter 4 and additional impact analysis presented in section 5.3 of this EIS Supplement.

The Draft EIS did not discuss four other species listed as Vulnerable on the NT List of Threatened Species that could potentially occur within the wider pipeline region and potentially within the pipeline corridor:

- *Angiopteris evecta*
- *Freycinetia excelsa*
- *Freycinetia percostata*
- *Mapania microcephala*

Records of the first three of the above species are found at the very edge of the 100 km pipeline region (and therefore well away from vegetation to be cleared in the 100 m pipeline corridor). These species grow in deep wet gorges or spring jungles avoided by the pipeline route. There are less than 10-12 records for each species and all records are over 20 years old (Figure 5-8). The fourth species, *M. microcephala* is known from only 2 records, approximately 19 km from the proposed pipeline corridor and also grows in spring jungles associated with plateau margins which is habitat avoided through the alignment of the pipeline route. For these reasons, expert advice from the NT Herbarium (I Cowie; pers. comm. June 2013) is that construction activities are unlikely to impact the above four species.

In early 2013, NT Flora Atlas records (maintained by the NT Department of Land Resource Management) were updated through a bi-annual 'synching' with the NT Herbarium database, and an additional three Threatened Species that could possibly occur in the pipeline region were identified:

- *Erythroxylum* sp. *Cholmondely Creek* (Endangered, on NT list only).
- *Intsia bijuga* (Critically Endangered, on NT list only).
- *Ectrosia blakei* (Vulnerable, on EPBC list; Data Deficient on the NT List).

None of these species were found in the 2003-2004 field survey (Draft EIS, Appendix C), and records from the NT Flora Atlas indicated that the first two were approximately 7 km and 11 km, respectively, from the pipeline (Figure 5-9). Further, *E.* sp. *Cholmondely Creek* is known from only one location in the region, from the Gove mine site, and two weeks of intensive targeted survey by NT Government botanists in the Gove area, as far west as the Dhalinybuy turnoff from the Central Arnhem Road, failed to locate any additional populations of this species (Ian Cowie, NT Herbarium; pers. comm.).

Similarly, *Instia bijuga* is known from only one location (33 mature individuals) in wet rainforest at Rocky Bay, just south of Yirrkala (Ian Cowie, NT Herbarium; pers. comm.). The pipeline route was selected to avoid this kind of habitat.

Neither *Erythroxylum* sp. *Cholmondely Creek* nor *Intsia bijuga* is therefore considered likely to occur in areas to be cleared for the ROW.

Ectrosia blakei, however, could potentially occur in the project area, based on the only two records for this species in the region (1972), which indicate that the species could occur within 1.5 – 2 km of the pipeline, as shown in Figure 5-10. The potential distribution of this species, its conservation status and potential impacts from the KGGP project are discussed in section 5.4.

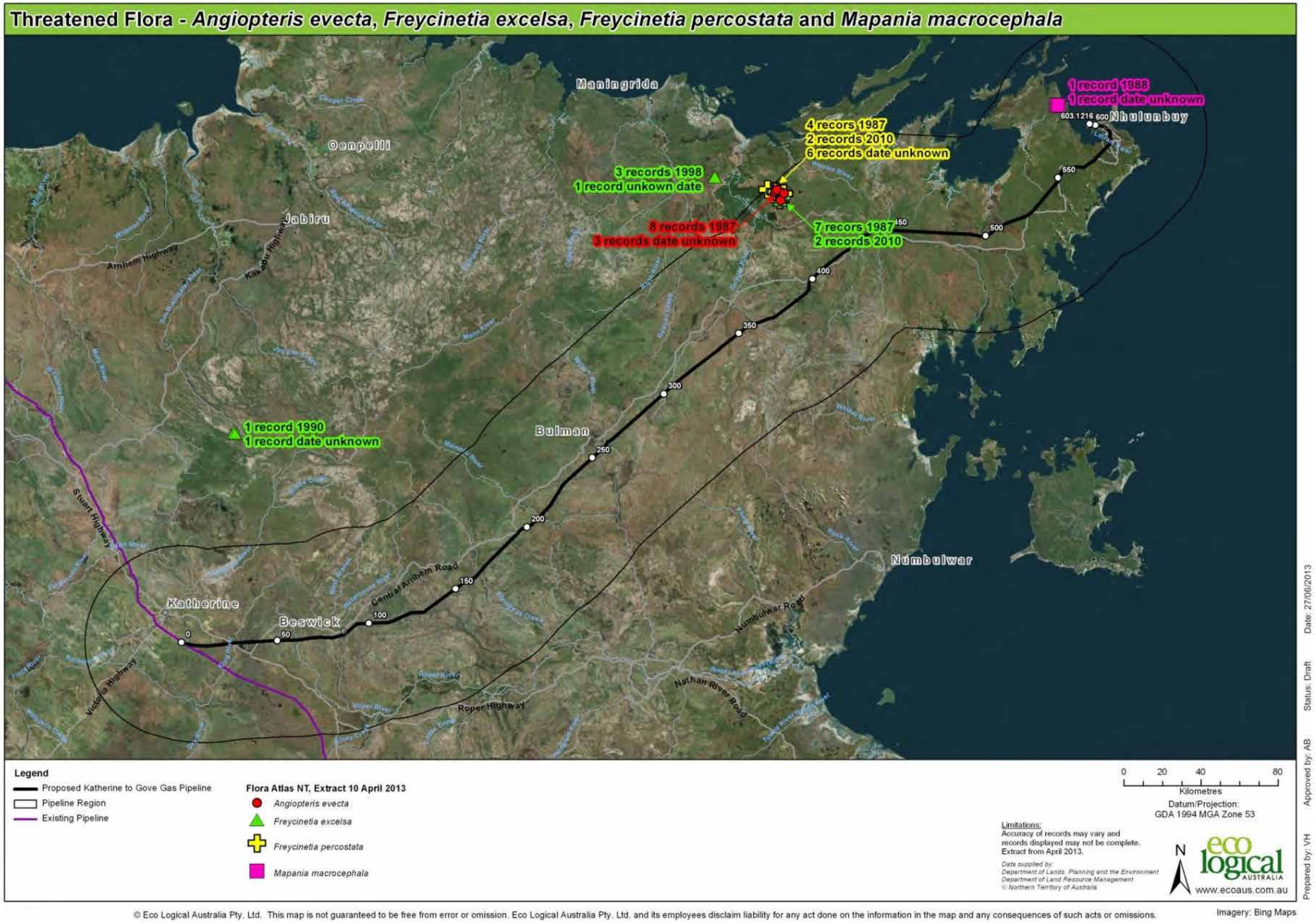


Figure 5-8: Records of threatened flora species *Angiopteris evecta; Freycinetia excelsa*; *Freycinetia percostata*; *Mapania microcephala*

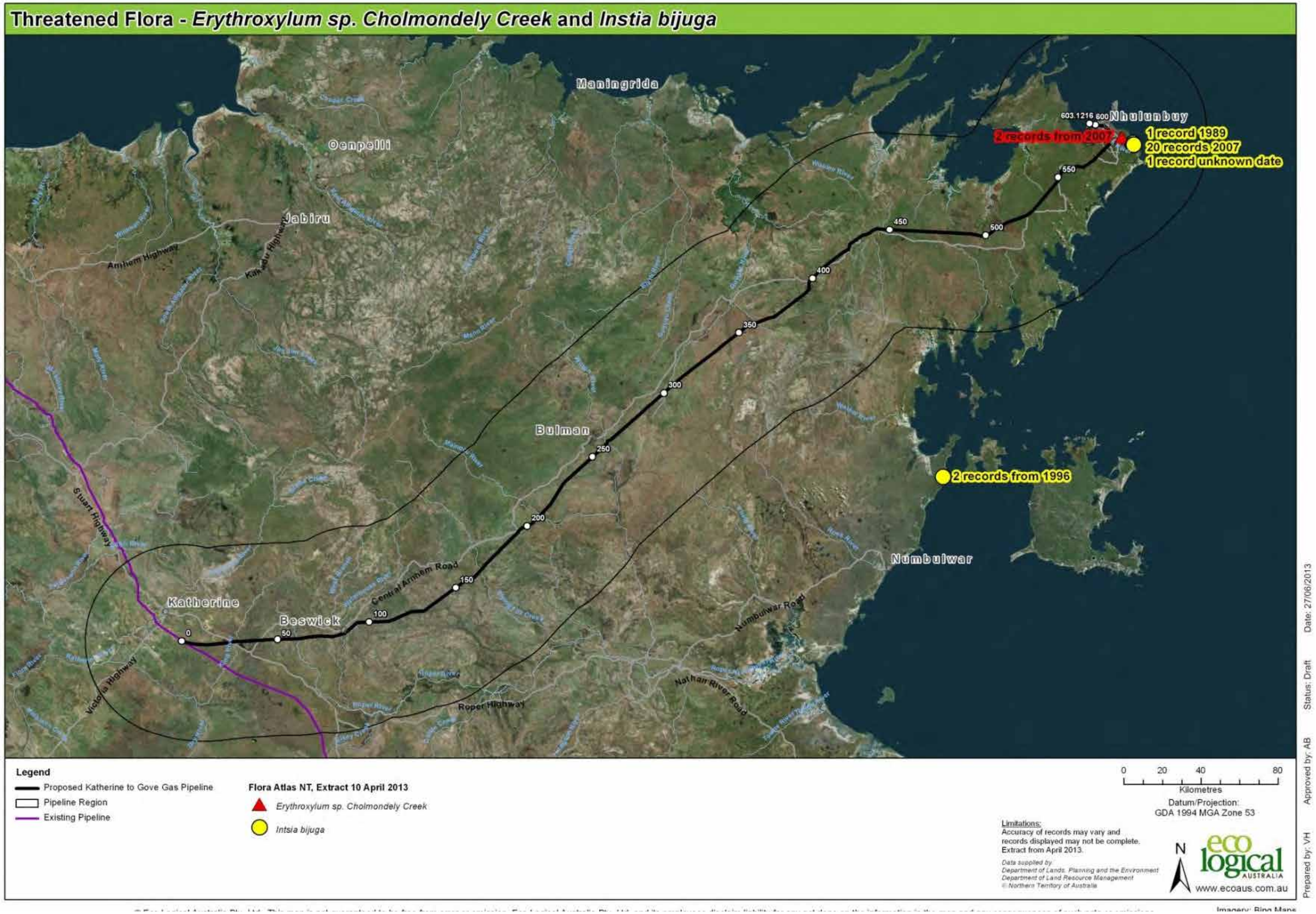


Figure 5-9: Records of threatened flora species *Erythroxylum sp. Cholmondely Creek* and *Instia bijuga*

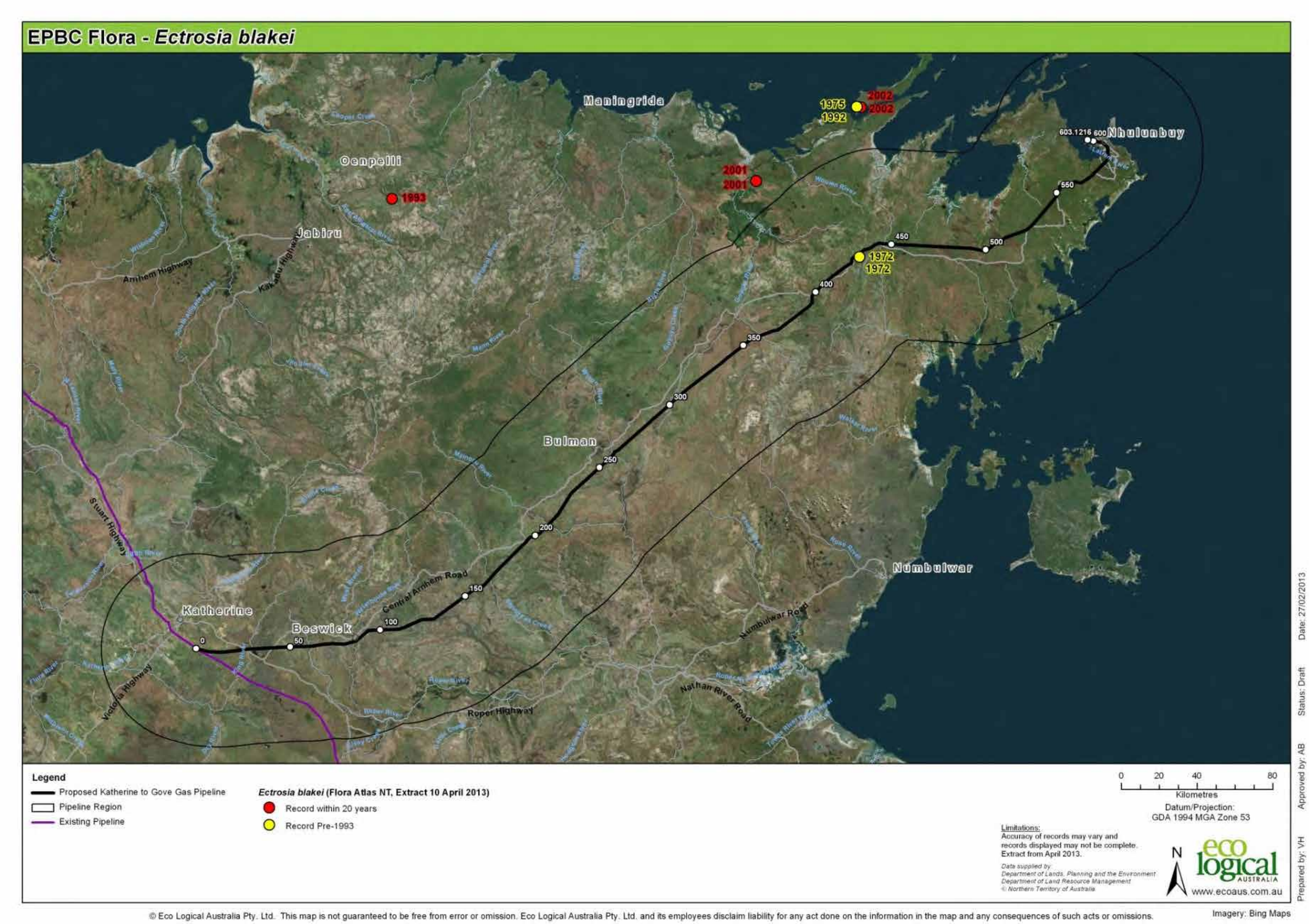


Figure 5-10: Records of threatened flora species *Ectrosia blakei*

5.3 THREATENED FLORA: *PTERNANDRA COERULESCENS*

5.3.1 Introduction

Pternandra coerulescens is listed as Vulnerable under the TPWC Act and is known to occur in riparian and rainforest habitats.

Additional survey conducted during the 2013 dry season (see section 4.3) confirmed the historical record of *P. coerulescens* in the region near where the pipeline corridor is proposed to cross the Latram River and provided a significant number of additional records indicating that the species may be more locally abundant than previously thought. However, the species was not recorded within the proposed pipeline corridor, the nearest survey record being 56 m from the proposed pipeline centreline (Figure 5-11).

5.3.2 Assessment of potential impact, mitigation and residual impact

As described in the Draft EIS, impact on riparian vegetation in proximity to the Latram River will be avoided through the use of horizontal directional drilling (HDD), enabling installation of the pipeline underneath the river. The entry and exit pits employed during HDD would be located outside the riparian zone favoured by this species and the pipeline would be installed beneath potential habitat for *Pternandra.* The use of HDD techniques when constructing the pipeline crossing of the Latram River is therefore expected to avoid all known occurrences of *P. coerulescens.* To confirm this, a qualified botanist will be on-site during construction of this HDD crossing to ensure that entry and exit pits are sited to avoid individual plants. Written confirmation that this has been achieved will be included in reporting against the project's overarching Environmental Management Plan (EMP).

In the unlikely event that HDD cannot be employed at the Latram River crossing for e.g. for geotechnical reasons, the survey confirmed that disturbance to riparian vegetation arising from open-trench crossing techniques would not remove any known occurrence of *P. coerulescens*. If open-trench techniques are required, a qualified botanist will be on-site during construction to confirm avoidance and if removal of currently unrecorded plants is required, the provisions of the TPWC Act will be complied with. Written confirmation that this has been achieved will be included in reporting against the project's overarching Environmental Management Plan (EMP).

In addition to the features of the project design and construction method described above that will avoid impacts on this species, the proponent has committed to a range of measures aimed at minimising the overall impacts of the project on the vegetation and flora, including:

- Clearing to occur only within a clearly marked and approved disturbance area.
- Vegetation to be cleared and areas rehabilitated progressively throughout construction to minimise the period of disturbance.
- Weed monitoring and control will be undertaken if weed distribution and abundance encroach on listed threatened and conservation significant species and vegetation communities (where this is attributable to disturbance associated with the project).
- Open ground fires will be prohibited throughout the entire area (except for fire training purposes).

The full list of proposed mitigation actions and anticipated effect of mitigation were provided in Table 8-4 of the Draft EIS. In addition, the over-arching Environment Management Plan (EMP, Appendix O of the Draft EIS) includes a range of sub-plans targeting key issues relating to the health and sustainability of vegetation species and communities:

- Vegetation Management Plan.
- Weed Management Plan.
- Introduced Fauna Management Plan.
- Fire Management Plan.
- Traffic Management Plan.
- Air Quality Management Plan.
- Hydrology and Water Quality Management Plan.
- Waste Management Plan.

After mitigation is applied, the Draft EIS reported that construction and operation of the KGGP is expected to result in the following outcomes in relation to vegetation:

- No removal of known recordings of any listed threatened flora species.
- Minimal disturbance to conservation significant flora species.

The additional targeted survey of the Latram River confirmed and strengthened these predictions regarding *P. coerulescens.*

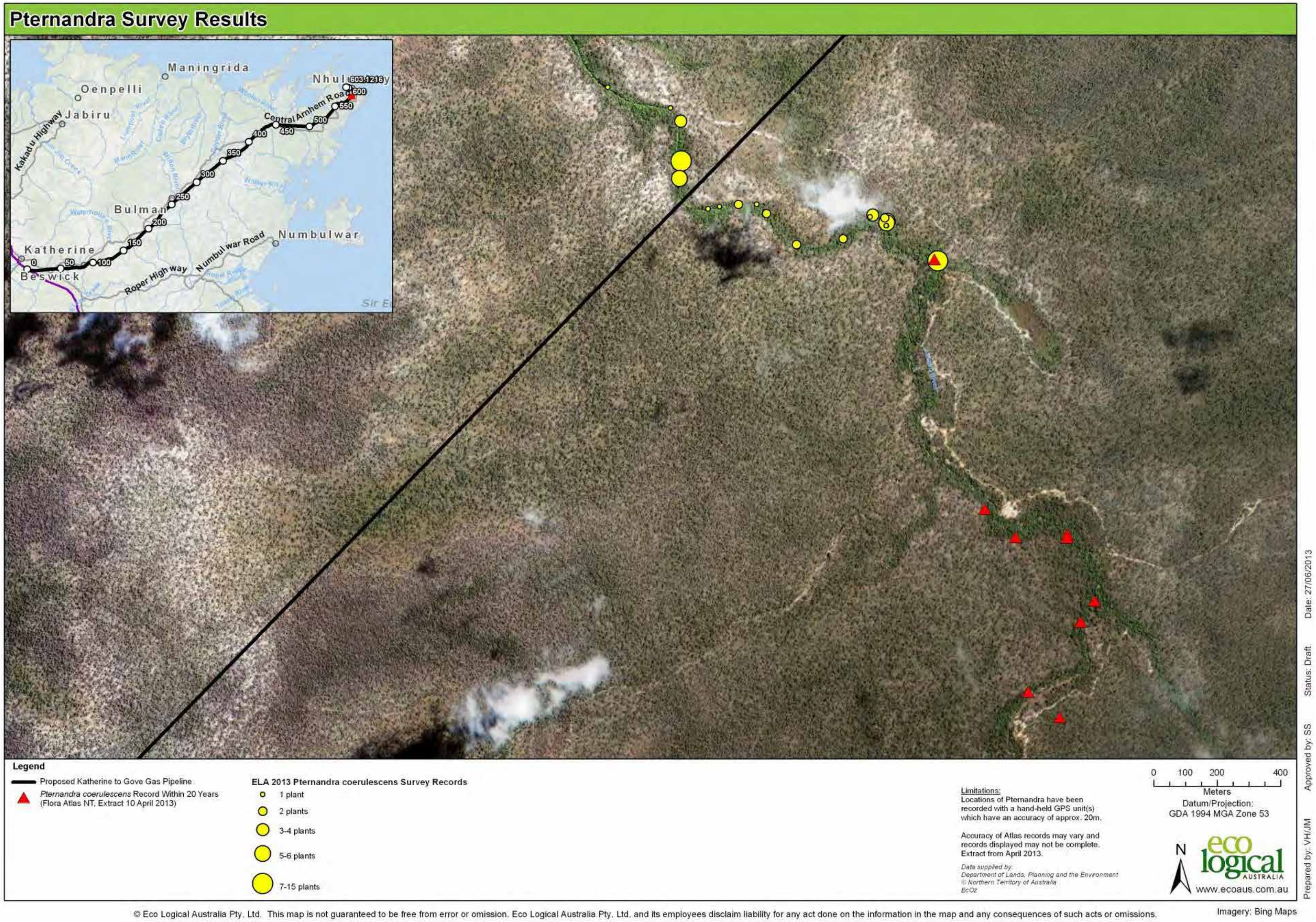


Figure 5-11: Survey records *Pternandra coerulescens* at Latram River site

5.4 THREATENED FLORA: *ECTROSIA BLAKEI*

Ectrosia blakei is classified as Vulnerable under the EPBC Act and the Nature Conservation Act 1992 (Queensland) and classified as Data Deficient under the TPWC Act (Northern Territory). The NT threatened species fact sheet for *Ectrosia blakei* (Cowie *et al*. 2006) states:

"In the NT, this species is coded as Data Deficient based on:

- Data are considered inadequate for assessment; and
- Known from four populations, none of which are believed to be under threat.

5.4.1 Introduction

E. blakei is a slender annual grass that grows up to 45 cm tall. It is very similar to three other *Ectrosia* species (*E. danesii, E. laxa*, and *E. schultzii* var. *annua).* The distinguishing features of these four grass species are poorly defined and need further taxonomic work by expert botanists (Cowie *et al.* 2006).

E. blakei is known from four widely separated locations in Arnhem Land (Figure 5-10), one large population (> 1000) on Elcho Island and three populations in northern Queensland. The population sizes, apart from the one on Elcho Island, are unknown (TSSC 2008). The grass is mostly found on laterite, white sand or sandy loam soils in woodlands dominated by *Eucalyptus tetrodonta, E. tectifica* or *Melaleuca nervosa*. The species is also found on seasonally poorly drained areas (Cowie *et al*. 2006).

There is little information available about abundance in populations of this species, and it is considered to be inadequately surveyed. At the optimal time of year for detection (late wet season and early dry season) sites are difficult to access. This and the remoteness of the area, lead to a negative collation bias. No data on area of occupancy are available. The known extent of occurrence is estimated at approximately 12,000km^2 (Cowie *et al*. 2006).

No threatening processes are known for the NT populations, as the species occurs in very remote locations and in areas least affected by European settlement. Fire during the main fertile period (May – June) could potentially be a threat to the annual grass, as it prevents seeds from developing. However, no information is available regarding the species' ability to recover from germination of older seed banks in the soil. Observations in northern Queensland indicate that the species flourishes under current cattle grazing regimes (Landsberg and Clarkson 2004). However, the Commonwealth Conservation Advice states that a change in grazing management may pose a threat to the species and should be monitored.

5.4.2 Methods

A search of the NT Atlas data (DLRM, April 2003) followed by a desktop study were undertaken to identify all known occurrences and determine the age and accuracy of the records and other information available on *Ectrosia blakei*. Advice from the NT Herbarium (I Cowie, Senior Botanist, pers. com.) was sought on the relevance of the data and the overall conservation status of the species.

5.4.3 Assessment of potential impact, mitigation and residual impact

The available records from the NT Atlas (DLRM, April 2003) show *Ectrosia blakei* was recorded at two sites, approximately 1.6 km from the proposed pipeline, near KP430 in 1972 (Figure 5-12). These records are more than 40 years old, and the accuracy of these records is only 1:100,000.

E. *blakei* was not recorded in the 12 detailed vegetation community surveys and the 77 vegetation community classifications conducted in the previously unsurveyed section of the pipeline corridor north of the Mitchell Ranges. These surveys were in proximity to the historical records and some were conducted in relevant habitat of the annual grass species.

Populations of *E. blakei* may be found along the pipeline route, as the habitats of the species, white sand or sandy loam soils in woodlands dominated by *Eucalyptus tetrodonta, E. tectifica* or *Melaleuca nervosa* woodlands, are common in the area (Figure 5-12). The species itself however, seems to be very rare and populations are likely to fluctuate due to the annual nature of the grass species.

It is unknown if the annual grass *E. blakei* could recover from old seed banks after the construction is finalised, as very little is known about the species in general. In comparison, other annual grass species are capable of recovering after disturbances such as fire (Lonsdale *et al.* 1998) and have frequently been reported to be the first to appear after disturbance (e.g. Valon *et al.* 2002). Landsberg and Clarkson (2004) state that *E. blakei* flourishes under grazing management, which indicates that the annual grass may benefit from a low degree of disturbance.

As an annual grass, *E. blakei* relies on seeds in the soil for its annual cycle and survival. Frequent fires during the fertile period (May-June) are likely to have the greatest impact on the species, as they can deplete the soil seed bank of the annual grass to a point where the species may no longer be able to persist; therefore, measures to avoid, mitigate and manage fire are considered necessary. The implementation of a Fire Management Plan (Appendix O, Draft EIS) prescribes avoidance, mitigation and management measures to reduce the potential impacts of fire within the pipeline ROW and region.

In addition, potential impacts on *E. blakei* will be avoided or minimised through relevant mitigation measures outlined in the EMP (Appendix O, Draft EIS), in relation to minimisation of amount of vegetation cleared; measures to avoid the introduction and spread of weeds; trampling by vehicles; minimising impacts from dust; and appropriate waste management.

Should the alternative alignment through the Mitchell Ranges be constructed, the proposed alignment would be a considerable distance (approximately 10 km) from the historical records of *E. blakei* and potential impacts are considered less likely.

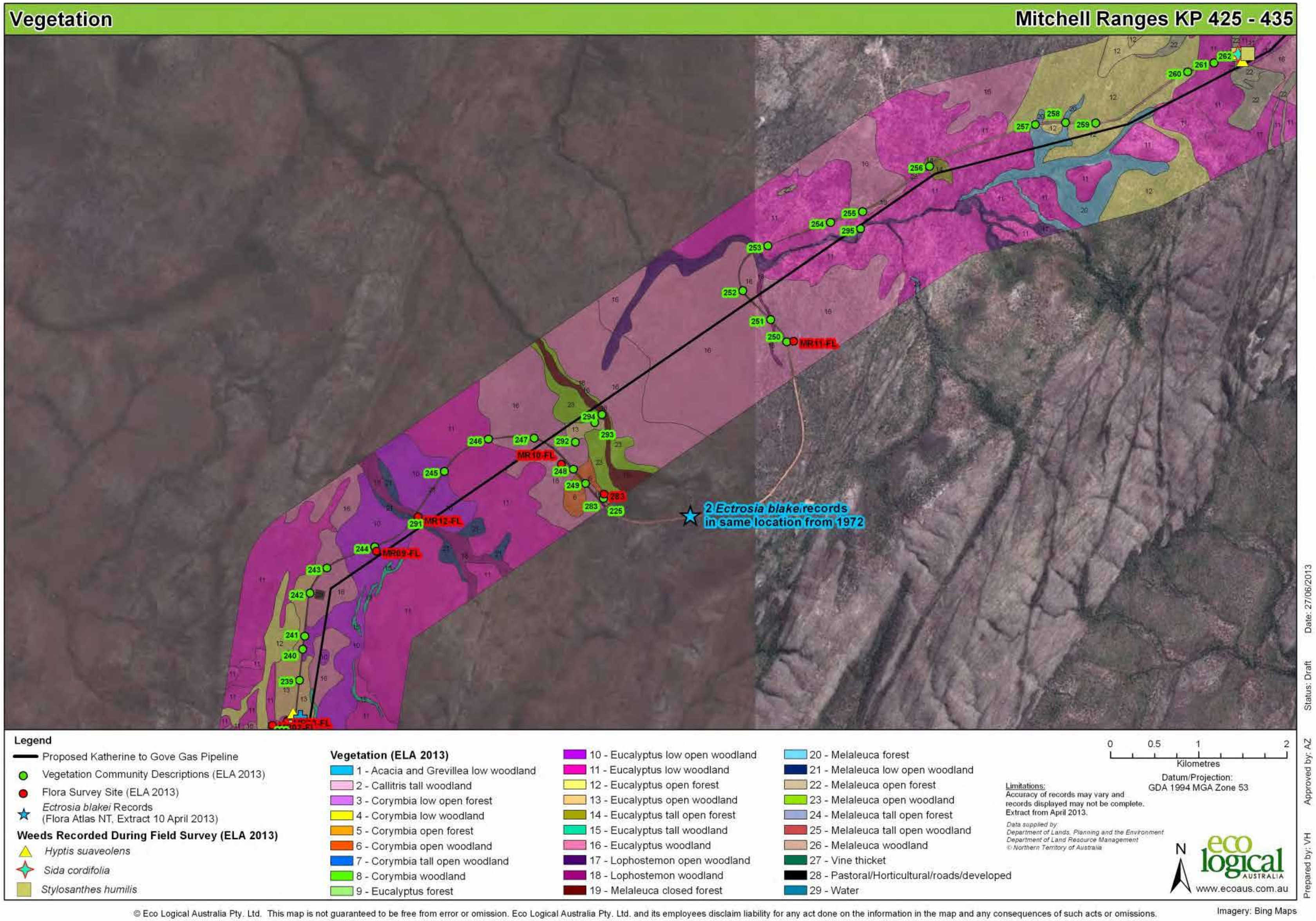


Figure 5-12: Closest record (1972) of *Ectrosia blakei* near the pipeline, with survey sites and vegetation mapping

5.5 THREATENED FAUNA: RED GOSHAWK (SECTION 10.6 OF DRAFT EIS)

5.5.1 Nesting and foraging habitat

The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. In the NT, the Red Goshawk prefers tall open forest and woodland, or tall fringing woodlands along rivers in grasslands, shrub-lands, and low open woodlands (NSW National Parks and Wildlife Service 2002). The species prefers extensive open forest, open woodlands and riparian vegetation dominated by mature *Eucalyptus tetrodonta*, *E. miniata*, and *Melaleuca leucadendron* (DERM 2012), and generally in savanna woodland with trees 15-40 m in height (Marchant and Higgins 1993). Forests of intermediate density are preferred, or ecotones between habitats of differing densities (DSEWPaC 2013). Red Goshawks avoid very dense and very open habitats (DSEWPaC 2013). Immature birds have been observed to irregularly use mangroves, open river floodplains, low open woodland, agricultural land and pasture (Marchant and Higgins 1993).

The Red Goshawk is a solitarily breeder (August to November), preferring biologically rich forested or wooded areas close to permanent water (e.g. river, swamp or pool), with large (over 20 m tall) trees. Nest trees have always been found located within 1 km of permanent water, often adjacent to rivers or clearings (Marchant and Higgins 1993). Red Goshawks hunt and breed in both lowland and rugged terrain (DERM 2012), where their diet consists largely of birds (95%) (DSEWPaC 2013), but also include mammals, reptiles and insects (Marchant and Higgins 1993).

The home range of females is estimated at 120 km^2, often flying 5 – 7 km away from nest when not breeding. Males have a wider home range of approximately 200 km^2 and have been radio-tracked to fly up to 7 – 10 km (and further out of radio range) away from nest, but are most often found up to 8 – 8.5 km from the nest. Other radio-tracking studies have recorded females and males hunting up to 6 km and 8 km away from nest, respectively (Marchant and Higgins 1993).

5.5.2 Loss of potential habitat

In the Draft EIS, potential habitat for Red Goshawk was mapped at a large regional scale using species-habitat associations. It was estimated that up to 2,200 ha of potential Red Goshawk foraging and/or nesting habitat would be expected to be disturbed through vegetation clearing in the project area including for ancillary infrastructure and access roads (of which 1,850 ha was attributed to construction of the ROW). Detailed vegetation mapping of the ROW (see section 4.1 of this EIS Supplement) has allowed for finer scale analysis as follows.

Vegetation within the pipeline corridor includes potential nesting and foraging habitat for the Red Goshawk. Studies described in Marchant and Higgins (1993) suggest high suitability nesting vegetation comprises tall trees within 1 km of perennial water; and foraging habitat includes a mosaic of vegetation units within 8 km of potential nesting sites. Potential nesting and foraging habitat of the Red Goshawk along the proposed pipeline corridor has been mapped by rating each of the vegetation units according to their suitability for habitat (Table 5-6), followed by spatial weightings related to distance: <1 km, 1 – 8 km and >8 km from perennial water (Table 5-7). A 0.2 km buffer was added to these distances to allow for braided channels and low-resolution drainage mapping. Perennial water is identified from the Geofabric Surface Network (BOM 2011) and includes creeks identified as 'perennial' flowing and 'major rivers/creeks' that may cease to flow but would have permanent disconnected pools. Additional perennial water features are included where known, from Gouldian Finch surveys (section 4.5 of this Supplement).

Table 5-6: Red Goshawk habitat suitability ratings of vegetation units along the pipeline corridor

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
A	Acacia forest
	Acacia open forest
	Acacia open woodland
	Acacia woodland
	Callitris tall woodland
	Canarium (mixed) closed forest
	Casuarina closed forest
	Casuarina woodland
	Corymbia forest
	Corymbia open forest
	Corymbia open woodland
	Corymbia tall open woodland
	Corymbia woodland
	Erythrophleum variable open woodland
	Eucalyptus closed forest
	Eucalyptus forest
	Eucalyptus open forest
	Eucalyptus open woodland
	Eucalyptus tall open forest
	Eucalyptus tall woodland
	Eucalyptus woodland
	Lophostemon closed forest
	Lophostemon open forest
	Lophostemon open woodland
	Lophostemon woodland
	Melaleuca closed forest
	Melaleuca forest
	Melaleuca open forest
	Melaleuca open woodland
	Melaleuca tall forest
	Melaleuca tall open forest
	Melaleuca tall open woodland
	Melaleuca woodland
	Mixed species open woodland
	Platyzoma swamp
	Vine forest
	Vine thicket
	Water

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
B	Acacia and Grevillea low woodland
	Acacia closed forest
	Corymbia low open forest
	Corymbia low open woodland
	Corymbia low woodland
	Erythrophleum low open woodland
	Eucalyptus low forest
	Eucalyptus low open forest
	Eucalyptus low open woodland
	Eucalyptus low woodland
	Melaleuca low open forest
	Melaleuca low open woodland
	Melaleuca low woodland
	Petalostigma pubescens low woodland
C	Aristida grassland
	Avicennia closed forest
	Beach
	Ceriops low closed forest
	Eriachne grassland
	Halosarcia low sparse samphire shrubland
	Heteropogon grassland
	Heteropogon open grassland
	Mixed tussock grassland/sedgeland
	Pastoral / Horticultural / Roads / Developed
	Rhizophora closed forest
	Sandstone shrubland
	Sparse shrubland
	Tussock grassland

Table 5-7: Spatial weightings based on distance to perennial water for potential Red Goshawk habitat

VEGETATION HABITAT SUITABILITY RATING	SPATIAL WEIGHTING (DISTANCE FROM PERENNIAL WATER)		
	<1 km	1-8 km	>8 km
A	High	Moderate	Lowest-None
B	Moderate	Low	Lowest-None
C	Moderate	Low	Lowest-None

Results of this spatial analysis identify that, approximately 252 ha of High suitability vegetation for Red Goshawk (potential nesting) would be cleared for the ROW (Figure 5-13 and Table 5-8), excluding riparian vegetation above HDD sites. This would result in this potential nesting habitat (High suitability woodland habitat) becoming foraging habitat as a result of the removal of the tall trees and replacement by grasses (Moderate suitability open habitat) (refers to ratings in Table 5-6 and Table 5-7). Over time, 60% of this impact area is anticipated to return to woody native vegetation (see Chapter 2 of the Draft EIS) and subsequently to its pre-clearing form and value. Residual impacts on High suitability vegetation for Red Goshawk (potential nesting) are therefore expected to be 101 ha.

The spatial analysis also indicates that 1,070 ha of Moderate suitability vegetation for Red Goshawk (potential foraging) would be cleared for the ROW. Post-construction, this area would be initially classed as Low suitability foraging habitat until 60% of the ROW returns to woody native vegetation and subsequently to its pre-clearing form and value. Residual impacts on Moderate suitability vegetation for Red Goshawk (potential foraging) are therefore expected to be 428 ha.

Table 5-8: Clearing of potentially suitable habitat for Red Goshawk within the ROW

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	252	14
Moderate	1,070	59
Low	169	9
Lowest-None	317	18
Total	1,808	100.00

5.5.3 Assessment of potential impact, mitigation and residual impact

Section 10.6 of the Draft EIS provided a detailed impact analysis regarding the Red Goshawk. The key conclusions included:

- The KGGP Project has the potential to directly impact the Red Goshawk through the destruction or disturbance of nests or nest sites, or by reducing prey availability from:
  - Vegetation clearing and habitat removal.
  - Degradation of water quality of permanent water on which species may depend
  - Vehicle movements during construction and operation resulting in the loss of individual fauna, through vehicle strikes.
  - Noise and vibration causing changes in behaviour (i.e. causing adults to abandon nest).
  - Ignition of hot fires late in the dry season could destroy nest trees if present (DERM 2012).
  - Dust and light emissions resulting in degradation/loss of habitat or change in behaviour of species.
- Similar areas of potential foraging habitat for the Red Goshawk (to those disturbed by construction of the pipeline) are not confined to the project area, and extend across the Top End.
- The proposed clearing is a small proportion of the likely home range of any individual Red Goshawk which has been estimated as approximately 20,000 ha (Garnett *et al*. 2011). Impacts on the Red Goshawk from foraging habitat removal are therefore not anticipated to be significant.

- The proposed clearing does not affect a known important population and is unlikely to cause any long-term impact on this species unless a currently unrecorded nesting area is disturbed.
- Significant riparian vegetation potentially supporting nesting habitat has largely been avoided through route selection and use of HDD at a large number of river crossings.
- Clearing of tall woodland near permanent water will be minimised in final alignment of the ROW within pipeline corridor.
- The narrow corridor is unlikely to represent a threat via fragmentation particularly once rehabilitation is implemented.
- The KGGP does not compromise any actions of the Red Goshawk National Recovery Plan (DERM 2012).
- It is considered unlikely that the Red Goshawk will be significantly impacted as a result of the project if the proposed mitigation and management measures are implemented. Suitable habitat for the Red Goshawk is broadly represented in the region and potential habitat to be cleared within the project area is unlikely to be locally or regionally significant and represents a small proportion of the home range for any individual Red Goshawk. Minimisation of disturbance to riparian vegetation will reduce the likelihood that nesting trees are disturbed.

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a), offsets are not required where the residual impact is not likely to be significant on MNES (with reference to the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009)).

The additional vegetation / habitat analysis conducted and presented in this EIS Supplement together with the additional commitment allowing for reduced working width when clearing the ROW in areas of high habitat value (see section 3.4 of this EIS Supplement) and commitment to minimise the clearing of tall woodland near permanent water in Table 10-5 of the Draft EIS), confirm and strengthen the conclusions presented in the Draft EIS regarding the Red Goshawk. With the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the KGGP Project on the Red Goshawk are unlikely to be significant based on the information that is currently available. As such, offsets relating to the Red Goshawk would not be required under the Commonwealth offsets policy.

5.5.4 Alternate tie-in alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-9.

No loss of High suitability vegetation and 11 ha of Moderate suitability vegetation for Red Goshawk (potential foraging) would be cleared. The conclusions presented above regarding the Red Goshawk would not therefore be significantly different, should this option be implemented.

5.5.5 Alternative Mitchell Ranges alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-10. Moderate suitability vegetation for the Red Goshawk (potential foraging) occurs across the majority of pipeline realignment, with 43 ha (20%) comprising high suitability vegetation. Given the results of vegetation analysis across the whole of the ROW, it is unlikely that the outcomes for the Red Goshawk would be significantly different, should this realignment option be implemented.

Table 5-9: Clearing of potentially suitable habitat for Red Goshawk within the ROW for the alternative tie-in alignment

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	0	0
Moderate	11	22
Low	12	24
Lowest-None	27	54
Total	50	100

Table 5-10: Clearing of potentially suitable habitat for Red Goshawk within the ROW for the alternative Mitchell Ranges alignment.

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	43	20
Moderate	118	57
Low	41	20
Lowest-None	6	3
Total	208	100

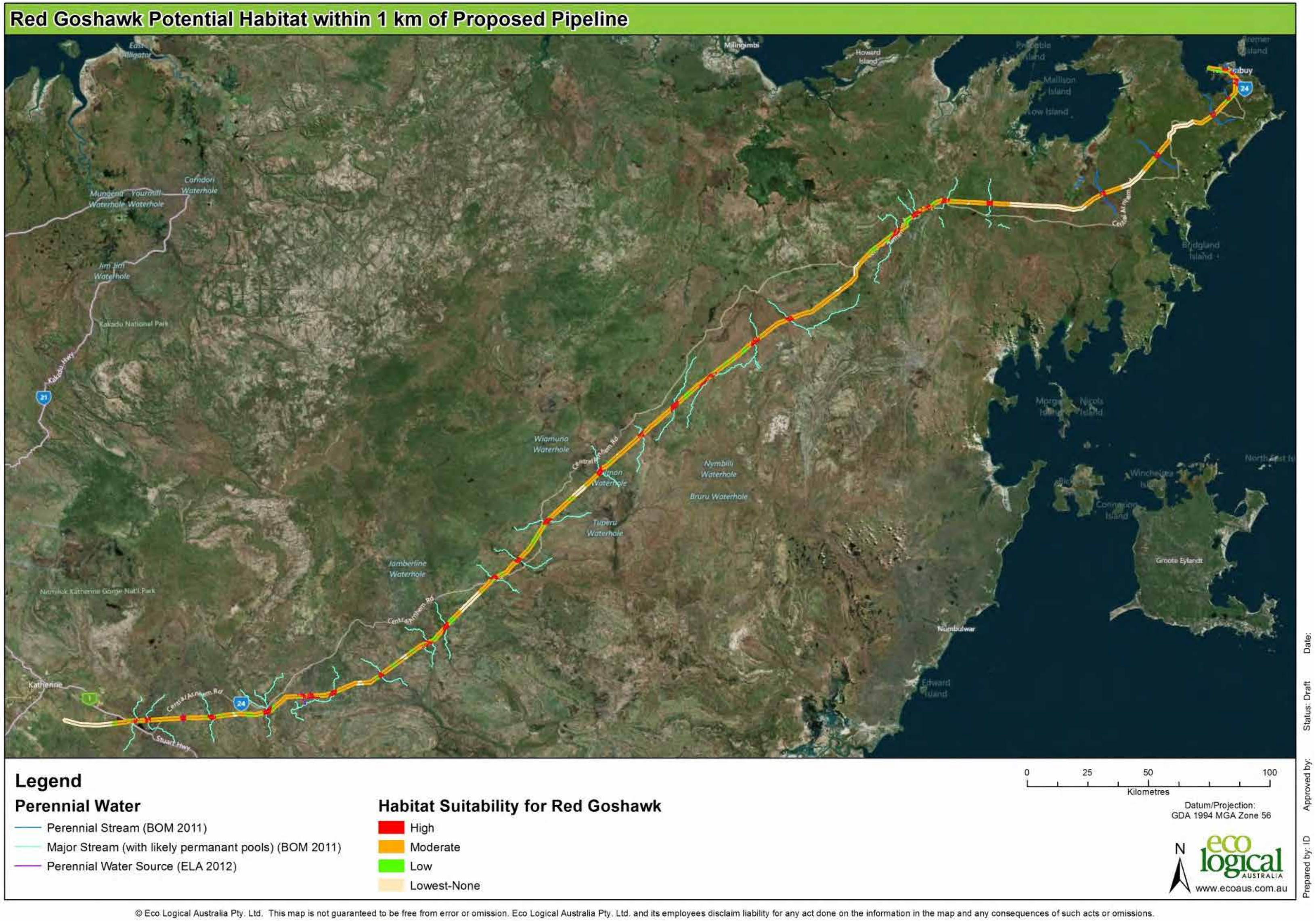


Figure 5-13: Red Goshawk potential habitat showing suitability ratings for nesting and foraging vegetation relative to distance from perennial water

5.6 THREATENED FAUNA: GOULDIAN FINCH (SECTION 10.7 OF DRAFT EIS)

5.6.1 Breeding (and coincident dry season foraging) and wet season foraging habitat

Breeding and wet season foraging habitats for the Gouldian Finch were generally described in section 10.7.3 of the Draft EIS. Gouldian Finches move seasonally between two different habitats (DLRM 2012). For most of the wet season (from about December/January), they occur in a variety of woodland types in lowland country with drainages, to feed on seeds of perennial grasses, such as soft spinifex, cockatoo grass and golden beard grass (available from mid-December; Dostine & Franklin 2002). In the late wet to dry season (February-August), they occur primarily in their breeding habitat of rocky hills with hollow-bearing smooth-barked gums (*Eucalyptus brevifolia* or *E. tintinnans*) within two to four kilometres of small waterholes or springs that persist throughout the dry season. They seek out hollows for nesting, preferentially selecting those hollowed out by termites in these trees (O'Malley 2006). Their dry season feeding habitat is dominated by annual spear grasses or native sorghum (*Sarga* species).

Gouldian Finches rely on dry season fires to clear undergrowth and enable them to more easily find seeds on the ground released by native sorghum, and find water at small rocky waterholes that persist in the hills until the following wet season.

5.6.2 Loss of potential habitat

Alignment as proposed in Draft EIS

Section 4.5 of this EIS Supplement provides mapping of the breeding (and coincident dry season foraging) habitat between KP0-140, following further survey during 2013. Establishment of the ROW for the pipeline is estimated to result in the:

- Clearing of approximately 165 Salmon Gum trees.
- Clearing of between 33 and 101 ha of breeding (and coincident dry season foraging) habitat.

In respect of wet season foraging habitat, the Gouldian Finch is thought to disperse from breeding areas to nearby sites (up to 20 km away) during the wet season in response to local changes in food availability (Dostine *et al.* 2001). O'Malley (2006) has noted that records of Gouldian Finches at Ethabuka in south- western Queensland indicate dispersal far from any known historical or current breeding sites; however, individual birds might travel as little as 2 km, or as much as 17 km in a single day (Woinarski & Tidemann 1992; O'Malley 2006).

The 1,850 ha of temporary clearing of possible wet season foraging habitat noted in the Draft EIS was based on the total project footprint and it was noted in the Draft EIS that the actual use of these areas as feeding habitat is dependent on close proximity to nesting and watering habitat (i.e. high value breeding and coincident dry season feeding habitat). The suitability of areas as feeding habitat during the wet season would also be dependent on the presence of perennial grasses such as soft spinifex, cockatoo grass and golden beard grass.

In the Draft EIS, potential wet season feeding habitat and breeding habitat along the pipeline corridor was determined at a broad scale using floristic data derived from the vegetation survey identifying where key flora species for Gouldian Finch habitat occur. Approximately 500 km of the pipeline alignment (or 1,500 ha of the pipeline ROW), which accounts for 81% of the pipeline ROW, was defined as a conservative estimate of the habitat likely to contain grass species important for wet

season foraging by Gouldian Finches, if breeding (and coincident dry season foraging) habitat were also nearby. This estimate has since been re-defined, using GIS analysis.

The process involved applying a 20 km buffer (being a conservative estimate of the distance of wet season dispersal from breeding areas) to the areas of breeding (and coincident dry season foraging) habitat mapped in the EIS, as well as the location of historical Gouldian Finch records near Bulman (see section 10.7.3 of the Draft EIS), to define the maximum extent of potential wet season foraging habitat for the species. This area totalled 603,511 ha (excluding areas of identified breeding (and coincident dry season foraging) habitat). The area of ROW within 20 km of known breeding (and coincident dry season foraging) habitat (i.e. the Beswick/Chambers River area) and potential breeding (and coincident dry season foraging) habitat (i.e. near Bulman) was approximately 396 ha. This area would be expected to contain vegetation that is both suitable and unsuitable for wet season foraging by the Gouldian Finch. To determine the area of potential wet season foraging habitat within the 396 ha envelope, the National Vegetation Information System (NVIS) vegetation Level 5 mapping was interrogated to identify areas of vegetation containing any or all of the following grass species: *Alloteropsis semialata*, *Chrysopogon fallax* (including *C. latifolius*), *Sorghum intrans*, and *Triodia bitextura*. Of the 603,511 ha of potential wet season foraging habitat located within 20 km of breeding (and coincident dry season foraging) habitat, approximately 492,615 ha contains at least one of these grass species. The area of vegetation within the 30 m ROW supporting these suitable grass species is approximately 378 ha. Therefore, 378 ha of Gouldian Finch wet season foraging habitat are likely to be cleared to establish the ROW. This represents 0.08% of the maximum extent of potential wet season foraging habitat within 20km of breeding (and coincident dry season foraging) habitat.

Alternate tie-in alignment

No identified breeding (and coincident dry season foraging) habitat occurs in or around the alternative ROW alignment for the tie-in (although Salmon Gums are present they lack the requisite proximity to perennial water sources). Loss of potential Gouldian Finch habitat in establishing the ROW for the alternative tie-in would be no greater than identified in the EIS for areas outside of breeding (and coincident dry season foraging) habitat (i.e. wet season foraging grassland).

Alternate Mitchell Ranges alignment

A preliminary habitat values survey of the Mitchell Ranges alternative alignment identified small patches of potential breeding (and coincident dry season foraging) habitat (see section 5.15) in the vicinity. The potential habitat is however, approximately 100 km from the nearest recent record for the Gouldian Finch. Subject to selection of the finalised alignment, it is anticipated that these patches of Salmon Gums will be avoided during final survey and pegging for the ROW. No loss of potential breeding (and coincident dry season foraging) habitat is therefore anticipated if this alternative alignment is implemented. Loss of potential Gouldian Finch habitat in establishing the ROW for the alternative Mitchell Ranges alignment would be no greater than identified in the EIS for areas outside of breeding (and coincident dry season foraging) habitat (i.e. wet season foraging grassland).

5.6.3 Assessment of potential impact, mitigation and residual impact

Section 10.7 of the Draft EIS provided a detailed impact analysis regarding the Gouldian Finch (for better clarity, references to ‘core habitat’ in the following summary of outcomes from the Draft EIS have been replaced with ‘breeding (and coincident dry season foraging) habitat’ throughout the rest of this EIS Supplement).

- Broad scale habitat association mapping indicates potential available habit across much of the pipeline corridor.
- The critical components of suitable core habitat for the Gouldian Finch are considered to be the presence of the species' favoured annual and perennial grasses, a nearby source of surface water and, in the breeding season, unburnt hollow-bearing Eucalyptus trees (in this case *E. tintinnans*) (DSEWPaC 2013).
- A cluster of records for the species occur at the south-western end of the project area, within 15 km, of the pipeline corridor, between KP0 and KP140. Notably, two isolated records occur within 15km of the pipeline corridor much further north-east between KP290 and KP320.
- Records for the species from survey within the project area include seven birds at sites approximately 1.5 - 2 km due south of the pipeline ROW (between KP103 and KP105) (2004 survey) and flocks of 100, 200 and 400 birds at sites within the pipeline corridor (KP118) (2012 survey).
- The recorded 2012 survey numbers suggest the Beswick/Chambers River population near KP118 may be an 'important population' as per the EPBC Act Significant Impact Guidelines (DEWHA 2009), in that it may be a 'key source population for breeding or dispersal'.
- Birds recorded during the 2012 survey were utilising a small water resource (a spring) in close proximity to the potential location of the ROW.
- An aerial survey for breeding habitat in the vicinity of the 2012 recordings of Gouldian Finches, found additional scattered watering resources in the surrounding area and a large (> 10 ha) area of smooth barked salmon gums (potential breeding habitat) to the southeast of the site where the birds were recorded (approximately 2 km from the pipeline corridor). Scattered groups of potential breeding trees were recorded within the pipeline corridor but generally, more substantial areas were found in the surrounding area.
- Potential wet season feeding habitat and breeding habitat outside of the area surveyed but along the pipeline corridor, was determined at a broad scale using floristic data derived from the vegetation survey, identifying where key flora species for Gouldian Finch habitat occur. Potential dry season feeding habitat was assumed to be coincident with breeding habitat. This analysis indicated three sites (between KP0 and KP50) where *Eucalyptus tintinnans* (salmon gum breeding habitat) was either dominant or recorded within the vegetation community (based on the 2003-04 flora survey of the pipeline corridor).
- Approximately 500 km of the pipeline alignment (or 1,500 ha of the pipeline ROW), which accounts for 81% of the pipeline ROW, can be conservatively predicted to hold habitat with grass species important for wet season foraging by Gouldian Finches <u>if</u> breeding and watering habitat were also nearby.
- Core habitat for the Gouldian Finch is traversed by the pipeline alignment, in particular the Beswick/Chambers River survey area.
- Wet season foraging habitat is of a vegetation/habitat is of a vegetation type that is characteristic of much of the land surrounding the pipeline as indicated by habitat association mapping. Foraging habitat between KP0 and KP140, including in the Beswick/Chambers River area, and potentially north-east of Bulman has the highest probability of actual use for feeding
- The potential to directly impact Gouldian Finches would be through destruction of nesting habitat or disturbance of nests; destruction of watering habitat; or by reducing seed availability from:
  - Vegetation clearing and habitat removal.
  - Physical disturbance to watering sites.
  - Alteration to hydrological regimes that supply watering sites.

  - Noise and vibration causing changes in behaviour (e.g. causing adults to abandon nests).
  - Changes to fire regimes.
- The net impacts on the Gouldian Finch from clearing of wet season foraging habitat were expected to be low as the extent of clearing estimated in the Draft EIS was small compared to the availability of similar habitat in the surrounding region and over 60% of the pipeline ROW and other disturbed areas would be established through natural and assisted revegetation. Residual impact was estimated as a maximum of 703 ha. Active rehabilitation with a focus on return of grass species favoured in the wet season should ensure any local reduction in the supply of seed is temporary.
- The narrow corridor is unlikely to represent a permanent impact via fragmentation, particularly with rehabilitation implemented.
- There is a potential for the closest of the three identified patches of breeding habitat to be destroyed during vegetation clearing for the ROW and further survey was committed to in this area.
- A Site Selection Protocol would prevent placement of ancillary infrastructure and access tracks in proximity to breeding habitat (Draft EIS, Appendix U).
- Impacts on the Gouldian Finch from the potential loss of breeding habitat from construction of the ROW is expected to be low and not have significant implications for populations, given the recorded availability of suitable breeding habitat in the surveyed areas outside of the pipeline corridor and likely occurrence in unsurveyed areas outside of the corridor, particularly where these are close to historical recordings of this species (conclusion subject to additional resource survey between KP0-140).
- Impacts from construction of the pipeline on Gouldian Finch dry season feeding habitat are expected to be low as rocky slopes have generally been avoided. Impacts on potential dry season feed habitat in the pipeline corridor in these areas will be minimised during final alignment of the ROW, supported by further resource mapping surveys this dry season.
- The small waterhole/watering habitat coinciding with the finding of the Beswick/Chambers River Gouldian Finch population has the potential to be directly disturbed through construction of the ROW. Dry season survey will confirm the extent to which the water resources can be avoided in final alignment of the ROW. Impacts on Gouldian Finch watering habitat elsewhere in the project area from construction of the ROW are expected to be low and short term.
- The residual impacts associated with the construction and operation of the KGGP Project on the Gouldian Finch may be considered moderately significant based on impacts occurring within core habitat for the species but minimised through proposed management measures.
- Pacific Aluminium is looking to work with the NLC to develop a habitat enhancement program that would be supported by funding of indigenous ranger groups to implement the program to improve habitat quality, with a focus on Gouldian Finch habitat. Indicatively, the enhancement program would involve an area up to ten times the area of potential Gouldian Finch habitat to be cleared.
- The KGGP Project does not compromise any actions of the Gouldian Finch National Recovery Plan (O'Malley 2006).

The results of additional habitat survey (section 4.5) have necessitated a re-evaluation of the impact assessment for the Gouldian Finch that was presented in the Draft EIS and summarised above.

A discussion of the key impacts, and other potential impacts on the Gouldian Finch in light of the findings of additional survey information, and details of proposed additional management approaches are presented below.

Clearing of habitat: additional mitigation

Salmon Gums with suitable nesting hollows are a critical resource for Gouldian Finches in the breeding season (February - August). Potential impacts of pipeline construction include clearing or disturbance of suitable nesting hollows or active nests. Suitable nesting habitat in the pipeline corridor occurs within a mosaic of large patches of suitable habitat in the surrounding vicinity (see section 4.5 of this EIS Supplement). It is currently estimated that between 33 ha and 101 ha of high value breeding (and coincident dry season feeding) habitat would be affected by clearing along the ROW. Although large areas of this habitat type occur outside of the pipeline corridor (ascertained from the mapping of 12,111 ha of breeding (and coincident dry season foraging) habitat within 2 km of the pipeline centreline), the residual impact on this breeding (and coincident dry season foraging) habitat is potentially a significant impact on the species because of the known occurrence of a significant population of the Gouldian Finch at Beswick/Chambers River. Additional mitigation measures to further reduce potential disturbance to breeding (and coincident dry season foraging) habitat have therefore been considered and are detailed below.

Minimising disturbance of trees with nesting hollows by re-alignment of the centreline.

Within the 100m pipeline corridor there is potential for fine scale route selection to avoid or minimise disturbance to high value habitats (see section 3.4 of this EIS Supplement for further explanation). A qualified ecologist will be on-site for pre-clearance pegging of the alignment of the 30 m ROW within the 100 m corridor at the following locations:

- Between KP0-140 (the area containing the majority of Gouldian Finch records and known breeding (and coincident dry season foraging) habitat).
- Any areas of the pipeline corridor containing Salmon Gums in the vicinity of the historical Gouldian Finch records near Bulman.
- Any other areas along the pipeline corridor where Salmon Gums with potentially suitable nesting hollows are recorded.

The ecologist will advise on the preferred alignment of the 30 m ROW such that disturbance to the following is minimised in order of decreasing priority:

a. Total number of Salmon Gums containing hollows suitable for Gouldian Finch nesting; and
b. Total number of all other Salmon Gums.

For any Salmon Gums located on or close to the eventual boundary of the ROW, determination of the preferred alignment in these areas will also take into consideration the potential for pruning branches, rather than felling whole trees. The final alignment of the 30 m ROW will match as much as possible the preferred alignment as advised by the on-site ecologist, subject to physical, technical and engineering constraints to the rate or amount of deviation possible for a given length of pipeline. Any deviation from the preferred alignment will be documented.

Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared.

As part of pegging the preferred alignment of the ROW, consideration will be given to reducing the width of the ROW for short sections to minimise the number of Salmon Gum habitat trees that would otherwise require removal.

Agreed requirements for realignment of the centreline, a reduction in the working width or special care to be taken to prune trees rather than clear-fell, will be noted on the Alignment Sheet for pipeline construction (see section 3.4 of this EIS Supplement) to ensure construction workforce are aware of and adhere to requirements.

Timing of removal of Salmon Gums to avoid disturbance of active nests

During the pre-clearance survey and pegging of the ROW, the ecologist will identify any nesting hollows in Salmon Gums that are in active use by the Gouldian Finch. Salmon Gums that do not have nesting Gouldian Finches and are not able to be avoided through realignment or reducing the working width of the ROW will be immediately cleared ahead of the main clearing program. This will ensure that Gouldian Finches do not subsequently nest in these particular trees in the interval between the pre-clearing survey and the main clearing program. If, at the time of pegging the ROW, active Gouldian Finch nests are present and cannot be avoided through realignment or reducing the working width of the ROW, the trees will be left in place until such time as the young are fledged and the nest is no longer in use. The ecologist present during pegging will estimate time to fledge and advise the clearing team of a suitable time to return to re-inspect and, if appropriate, fell the tree. The outcome of these arrangements is to avoid the loss of any active Gouldian Finch nesting within Salmon Gum hollows in trees requiring removal to establish the ROW.

Creating artificial nesting habitat in nearby areas using hollows from Salmon Gums that cannot be avoided and are required to be removed

Where Salmon Gums cannot be avoided through a combination of realignment of the ROW and/or a reduction in the working width of the ROW, any hollows in these trees will be salvaged during clearing and used in the creation of artificial nest boxes in nearby trees. The significance of artificial nest boxes is highlighted by Pryke (2010), who states: "To compensate for removal of hollow-bearing trees, breeding areas should be supplemented with artificial nest-boxes. Recent research in a number of disturbed and undisturbed sites has shown that custom-built nest-boxes specifically designed for Gouldian Finches can increase local densities by 77-320%, and fledging success (juvenile recruitment) by up to 338%. During land clearing, the collection of all hollow branches (hollows of about 5-15 cm in diameter) will aid in the construction of nest-boxes. The custom-designed nest-boxes are created using a rain- and heat-resistant main breeding chamber attached to natural hollow logs. The outcome of this measure is no net loss of breeding hollows for Gouldian Finches as a result of any removal of Salmon Gums to establish the ROW for the pipeline.

Although the mapping for potential Gouldian Finch habitat presented in this Draft EIS Supplement (Figure 10-4) depicts broad areas of high potential habitat across the pipeline corridor, few records of the species exist to the north-east of the Beswick/Chambers River area (Figure 10.5, Draft EIS). Given the historic records of the species in the Bulman area, this location is considered to be one of the more likely areas along the pipeline corridor outside the Beswick/Chambers River area that could contain potential breeding habitat for the species; however, it is possible that Gouldian Finch habitat occurs in other areas along the pipeline. For this reason, the management approach to be taken when constructing the pipeline in areas of known Gouldian Finch breeding habitat will be applied across the entire KGGP project area wherever any Salmon Gums with potentially suitable nesting hollows are located.

Additional analysis presented in section 5.6.2 has refined the predicted area of wet season foraging habitat that will be affected by establishment of the ROW. The predicted removal of 378 ha of wet season foraging habitat is lower than predicted in the Draft EIS (1,500 ha) and represents an upper (conservative) estimate given that the actual use of these areas as feeding habitat is dependent on close proximity to nesting and watering habitat within and outside of the project area. Following construction, reinstatement of the ROW and rehabilitation measures proposed in the Draft EIS would see rapid re-establishment of grassy habitat over the subsequent wet season and near complete re-establishment of the disturbed habitat. Any impact on wet season foraging habitat will be short term and limited to a very small area of its local and regional availability. The additional habitat analysis has confirmed and strengthened the conclusion in the Draft EIS that residual impact on this habitat type would be low.

Disturbance to water sources: additional mitigation

Most potential Gouldian Finch water resources within the pipeline corridor occur within drainage lines (watercourses). Although the majority of watercourses will cease to flow during the dry season, multiple pools of varying sizes in the wider landscape are likely to persist throughout the dry season and their proximity to breeding habitat has been used to define breeding (and coincident dry season foraging) habitat between KP0-140.

Section 6.2.3 of this EIS Supplement outlines the Risk Assessment and Adaptive Management (RAAM) approach to construction of watercourses. A weather assessment has been undertaken and current scheduling of construction is based on statistical median weather conditions across the project area. This assessment and preliminary reconnaissance of the project area during the 2013 dry season provide an adequate level of confidence that in median dry season conditions, the watercourse crossings (not already identified as HDD) would be dry or in low flow conditions, which would facilitate the use of standard open cut techniques of up to one day in-stream open trench duration. Section 6.2.3 and the RAAM process also establish the measures to be taken in the event of significantly higher than average wet season rainfall preceding the construction phase. Where practicable, crossing of the watercourse will be delayed until such time as a dry/low flow crossing can be undertaken using standard open cut crossing techniques. Where the on-ground risk assessment indicates use of standard open cut techniques (open trench duration up to one day) are not suitable, alternate crossing techniques (including flow diversion open cut or HDD) would be considered. These additional risk and adaptive management measures, coupled with the availability of pools in the wider landscape confirm the conclusions in the Draft EIS that impacts on potential Gouldian Finch watering habitat on drainage lines would be low.

Water sources that are independent of drainage lines are much more likely to be significant for Gouldian Finch populations. The additional survey conducted in April/May 2013 for the EIS Supplement identified one spring-fed waterhole (in the vicinity but not within the pipeline corridor) that is likely to be critical to the survival of a known population. This waterhole (near KP118) is where approximately 500 finches were observed drinking in the 2012 late dry season survey (Draft EIS, Appendix D). No other water features were close enough to the proposed pipeline to require a particular management strategy.

The current alignment of the pipeline corridor avoids the waterhole located near KP118, however, to increase the buffer distance between the waterhole and construction activities, it is proposed to adjust the alignment of the ROW within the current 100 m pipeline corridor. The pipeline would be located to the northern boundary of the 100 m pipeline corridor (between KP117 and KP118.5) providing a

buffer distance from the centreline of the proposed alignment to the waterhole of approximately 190 m (Figure 5-14).

Summary of additional mitigation measures

The additional mitigation measures for the Gouldian Finch proposed above are summarised in Table 5-11.

Table 5-11: Summary of additional proposed mitigation for potential impacts on Gouldian Finches

IMPACT	ADDITIONAL AVOIDANCE / MITIGATION / MANAGEMENT
Loss of potential breeding habitat	Pre-clearing assessment by qualified ecologist. Minimising disturbance of trees with nesting hollows by re-alignment of the centreline. Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared.
Disturbance or loss of nests	Pre-clearing assessment by qualified ecologist. Minimising disturbance of trees with nesting hollows by re-alignment of the centreline. Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared. Timing the removal of Salmon Gums to avoid disturbance of active nests. Creating artificial nesting habitat in nearby areas using hollows from Salmon Gums that cannot be avoided through realignment or reducing the working width of the ROW.
Disturbance or loss of water in drainage lines or disturbance of drinking individuals	Risk assessment and adaptive management process for watercourse crossings incorporating option to delay construction of crossing until dry.
Disturbance or loss of spring complex at KP118	Shifting of ROW to the north of the corridor to increase the distance between construction activities and waterhole.

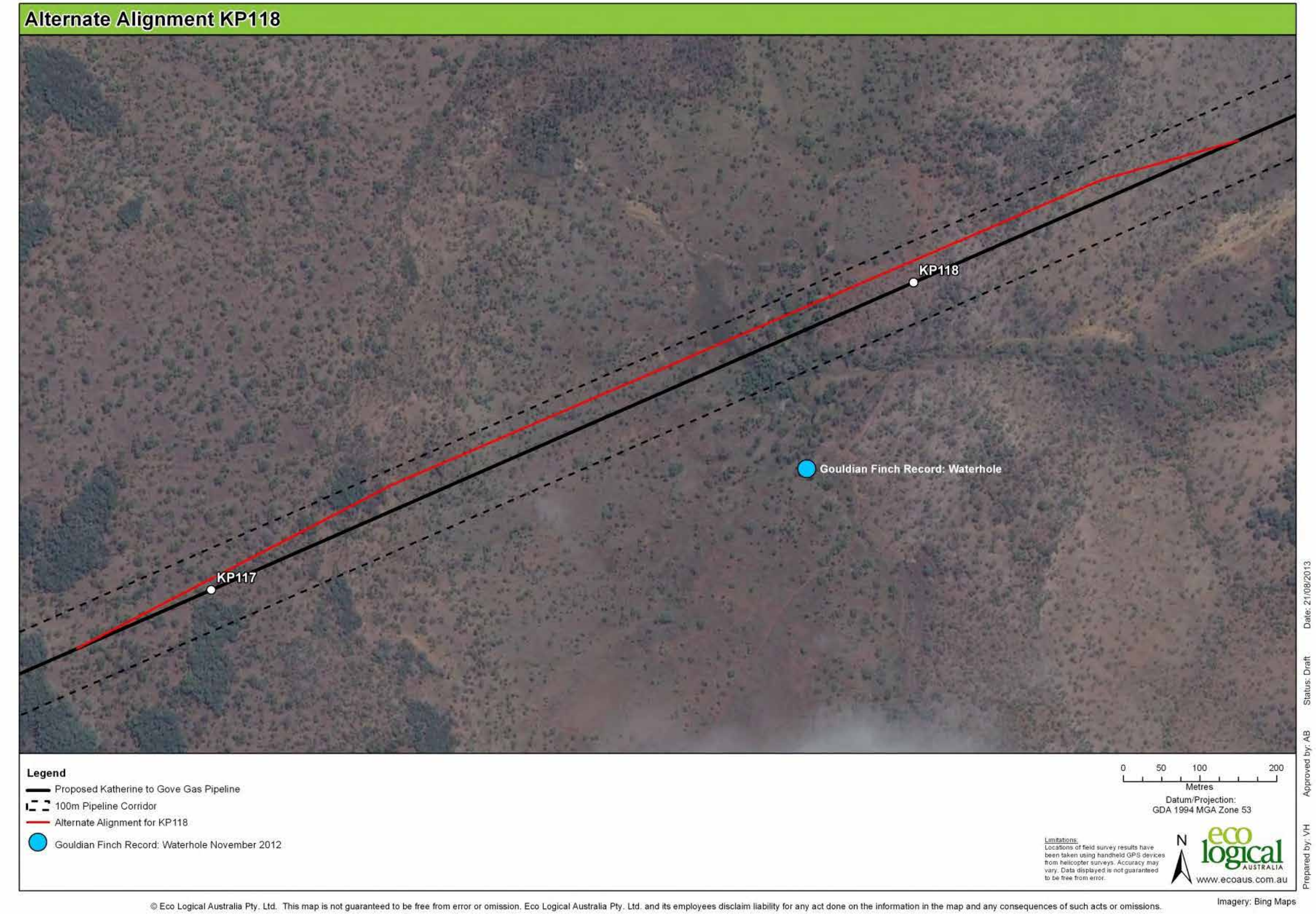


Figure 5-14: Proposed realignment of the ROW within the pipeline corridor to increase buffer distance to the waterhole where Gouldian Finches recorded 2012

Monitoring program for the Gouldian Finch

The Draft EIS included a commitment to implement a monitoring program for the known population of Gouldian Finch at Beswick/Chambers River in the vicinity of the waterholes near KP118 during construction and for three years following construction. The objective of the monitoring would be to confirm construction is not having/has not had a detrimental impact on the Gouldian Finch population and to provide further information on the population itself in terms of population dynamics and resource use by Gouldian Finches in this area.

In addition to evaluating population numbers in the years following construction, such monitoring would also contribute to the broader understanding of a possible significant resident population, in the context of a large series of Gouldian Finch sightings in new locations across the Top End in the past years which has led the Northern Territory Government to recently relax the conservation status of the species from Endangered to Vulnerable.

The primary aims of the monitoring program will be to:

- Estimate the approximate size of the breeding population in the vicinity of the waterholes near KP118 and to examine any trends over the monitoring period (3 years following construction).
- Measure breeding success as an indicator of population viability.
- Identify which areas identified as breeding (with coincident dry season foraging) habitat are being used by Gouldian Finches in the vicinity of the waterholes near KP118.
- Monitor habitat condition, including nesting trees and foraging grasses, in the vicinity of waterholes near KP118 during construction and early operation of the pipeline.
- Examine movement within and directly adjacent to mapped habitat in the vicinity of the waterholes near KP118 in order to determine movement patterns and habitat use, and/or any linkages with other nearby populations.

Monitoring would be scheduled as appropriate to the aspect being monitoring. A combination of field techniques such as regular bird counts (adults and juveniles) standardised transect, deployment of motion activated cameras or song recorders, observations of foraging behaviour, monitoring transects, as appropriate to the aspect being monitored (Table 5-12). The number of transect-plots and transects would follow accepted methods for biodiversity surveys and the 'Survey Guidelines for Australia's Threatened Birds' (DEWHA 2010) would be followed regarding searches for Gouldian Finches.

The local indigenous ranger group (Balaga Rangers) would be offered the opportunity to assist with monitoring.

A report on the monitoring results would be prepared annually. The report would be submitted to DSEWPaC and DLRM and also be made publically available.

Table 5-12: Indicative methods for Gouldian Finch monitoring

MONITORING GOAL	ACTIVITY	METHODS
Estimate the size of the breeding population in the area and examine trends over time.	Annual population census – post-breeding season at known watering location near KP118	Dawn surveys Remote motion activated cameras at suitable pools
	Breeding population census -	Observation at end of dry season Inspection of suitable hollows
Identify which areas are being used by Gouldian Finches for breeding, food and watering.	Year round surveys for bird activity in vicinity of waterholes near KP118 to focus on: • Burnt areas with exposed grass seeds • Lowlands with maturing grass seeds • Termite hollows in *Eucalyptus tintinnans*	Observations, remote cameras, song recorders
Determine habitat condition across the area of impact in the vicinity of the waterholes near KP118 during construction and early operation of the pipeline.	Monitor grass condition	Note extent and condition (seeding and senescence) of grasses
	Monitor fire impact	Identify extent of uncontrolled fire. Adjust fire plan to protect breeding (and coincident dry season foraging) habitat if uncontrolled fires have threatened breeding (and coincident dry season foraging) habitat.
	Monitor water resources	Inspect known water sources near KP118 for unusual drying or disturbance by pigs/buffalo.
	Monitor of weeds	Surveys to identify weed establishment. Follow up inspections post weed control activities

Offsets for the Gouldian Finch

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a), offsets are not required where the residual impact on MNES is not likely to be significant (with reference to the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009)).

It is currently estimated that up to 101 ha of breeding (and coincident dry season foraging) habitat would be affected by clearing along the ROW (with potential for further reduction through minor realignments and reduction of working widths through this area). It is considered that although large areas of this habitat type occur outside of the pipeline corridor, as ascertained from the mapping of 12,111 ha of breeding (and coincident dry season foraging) habitat within 2 km of the pipeline centreline, the residual impact on this breeding (and coincident dry season foraging) habitat is potentially a significant impact on the species because of the known occurrence of a significant population of the Gouldian Finch at Beswick/Chambers River. An environmental offset is proposed to mitigate the extent of the residual impact according to the Commonwealth *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a).

It is noted that approximately 378 ha of wet season foraging habitat will also be affected by the proposal. Offsets have not been proposed as the residual impact on this habitat type is considered low. The more detailed recent mapping of this habitat type demonstrates that this habitat is widespread in the region around the pipeline corridor and the residual impact of clearing 378 ha is not significant, representing 0.08% of the maximum potential wet season foraging habitat within 20km of breeding (and coincident dry season foraging) habitat. The foraging grasses along the ROW are likely to rapidly recover following reinstatement. Very few disturbed areas will be required to be free of grassy habitat following reinstatement. With the rehabilitation measures proposed, re-establishment of wet season foraging habitat following disturbance will be near complete. Any impact on wet season foraging habitat will be short term and limited to a very small area in context of its local and regional availability. The further analysis presented in this EIS Supplement confirm the conclusion in the Draft EIS that an offset is not required regarding wet season feeding habitat for the Gouldian Finch.

Habitat quality of the 101 ha of breeding (and coincident dry season foraging) habitat affected has been determined for the purpose of calculating offset requirements as per ‘How To Use The Offsets Assessment Guide’ (DSEWPaC 2012a). The habitat quality of the impact area is considered to be very good (Table 5-13), with a numerical value of ‘8’ (for the purpose of input to the Commonwealth Offsets Calculator). This is based on a good site condition and habitat diversity, and very good species stocking rate, with the confirmed presence of a large population of Gouldian Finch at Beswick/Chambers River.

A number of attributes have been applied to the proposed offset and included in the Gouldian Finch habitat enhancement/fire management program described in section 10.7.4 of the Draft EIS. These attributes have been entered into the project offsets calculator for the purpose of determining the total area required to be subject to the fire management program to mitigate 100% of the significant residual impact on breeding (and coincident dry season foraging) habitat. Following the application of these attributes, it has been assessed that the minimum offset area is 931 ha (Table 5-14). In practice, the area subject to the program may be larger than this for the purpose of implementation however, this represents the minimum area of breeding (and coincident dry season foraging) habitat that Pacific Aluminium proposes to include in the offset.

Additional detail on the proposed habitat enhancement/fire management program that shall constitute the offset is provided below.

Breeding (and coincident dry season feeding) habitat and wet season foraging resources can be managed using fire at appropriate times and scales. The following guidelines will be used to effectively protect and enhance resources; however, these guidelines may need to be balanced with other objectives across the landscape (e.g. asset protection, weed control and riparian protection). Timing of management activity would vary across the landscape and be dependent on local conditions (e.g. soil moisture, seed drop, senescence of annual grasses and movement of birds).

Areas near permanent water would be burnt early (late wet season or early dry season) to prevent high impact fires when birds are aggregated at the end of the dry. An early season burn is suitable because birds would be spread across a larger area, using other ephemeral water sources. An early burn would also minimise harm to riparian vegetation and Salmon Gums.

The final habitat enhancement/fire management program will be developed in consultation with a fire management specialist, Gouldian Finch expert, the NLC and indigenous landholders. As set out in the Draft EIS, Pacific Aluminium would fund indigenous ranger groups to undertake the program.

Table 5-13: Assessment of habitat quality of affected Gouldian Finch habitat

<table>
<tr><th>COMPONENT OF QUALITY</th><th>PROPOSAL AREA ANALYSIS</th></tr>
<tr><td>Site condition</td><td>
The original habitat association modelling undertaken for the draft EIS using vegetation communities broadly associated with Eucalypt woodland and topography (including hills, plains and rises) indicated the occurrence of areas of moderate-higher probability of Gouldian Finch habitat along the proposed pipeline corridor. The usefulness of this habitat association modelling for purpose of broad assessment of areas of higher potential value to Gouldian Finch is noted by the confirmation of approximately 90% of known Gouldian Finch records across the Top End of the NT occurring in the areas mapped as moderate-higher probability of Gouldian Finch habitat (Pacific Aluminium 2013, Appendix F).
Key habitat resources for Gouldian Finch were recognised in the draft EIS occurring along the pipeline corridor, which included nesting trees, dry season foraging areas, water sources close to nesting trees and dry season foraging, and wet season foraging habitat (the latter being broadly distributed along the pipeline corridor).
In particular, potentially suitable nesting trees and dry season foraging areas close to water sources have been identified along the pipeline corridor, mainly between KPs 0 and 140. This coincided with the finding of the significant Chamber Rivers/Beswick population of Gouldian Finch.
Since the draft EIS, further field work and habitat mapping has been undertaken to refine the estimates of impact to Gouldian Finch habitat based on definition of

Patches of Salmon Gums (suitable nesting trees) within 4 km of permanent water (defined as ‘breeding (and coincident dry season foraging) habitat’);
Wet season foraging habitat

It is currently estimated that up to 101 ha breeding/dry season foraging habitat would be affected by clearing along the ROW (with the potential for further reduction through reduction of working widths through this area. Approximately 378 ha of wet season foraging habitat will also be affected but this has not been considered further in the offsets calculation as this habitat type is widespread in region around the pipeline corridor and the impact of clearing 378 ha is negligible particularly in consideration of the likely rapid recovery of foraging grasses along the ROW following reinstatement.
The 101 ha area of breeding (and coincident dry season foraging) habitat is considered of moderate vegetation condition and structure, showing signs of low structural diversity due to recent burns and the long term frequent occurrence of hot intense burns in the area based on the site assessments at Beswick/Chamber Rivers and observations during the habitat resource surveys. It was noted that the occurrence of grasses was somewhat patchy in those areas surveyed potentially as a result of frequency of fires. An alteration in woodland structure over time as a result of burns destroying tree saplings could also affect the availability of suitable nesting trees with hollows in the longer term and affect vegetation succession. There is also evidence of grazing impacts in this area, however these impacts are most likely secondary to those of fire.
</td></tr>
</table>

COMPONENT OF QUALITY	PROPOSAL AREA ANALYSIS
	The breeding (and coincident dry season foraging) habitat is characterised by a good diversity of habitat types and high number of habitat features for the species with the occurrence of breeding trees, dry season foraging areas close to these trees and the presence of permanent and semi-permanent water. The spring-fed waterhole system recorded near KP118 is the only permanent water feature that occurs in close proximity to the pipeline ROW. Other water available in breeding (and coincident dry season foraging) habitat areas is within drainage lines that are likely to hold ephemeral pools throughout the year.
Site context	The Gouldian Finch is sparsely distributed across northern Australia from the Kimberley region of north-western Western Australia to north-central Queensland (DSEWPaC 2013). The species is currently known to occur in significant numbers (> 50 adult birds) at only 10 locations, including five in Western Australia; and five in the Northern Territory (O'Malley 2006). The nearest of these locations to the site is Yinberrie Hills which lies approximately 40 km north of the pipeline corridor. Approximately 12,111 ha of breeding (and coincident dry season foraging) habitat available for Gouldian Finch has been mapped within 2 km of the pipeline centreline (limit of survey area), as well as six watercourses and ten permanent water features (ELA 2013). The 101 ha of breeding (and coincident dry season foraging) habitat impacted is generally in the same condition and appears to be subject to similar threatening processes as the breeding (and coincident dry season foraging) habitat in the surrounding areas that were within the remaining mapped area. For this reason, the impact area is not considered of particularly higher value nor is it distinctive from the remainder of the breeding (and coincident dry season foraging) habitat mapped (and foreseeably that breeding (and coincident dry season foraging) habitat that occurs beyond the mapped area). The potential threats to the Gouldian Finch within the site and surrounds include declines in the extent and/or quality of habitat from fire and grazing pressure (O'Malley 2006) and also threats from feral cats which are suspected to contribute to declining populations of small fauna (Tidemann 2006, Woinarski et al 2010).
Species stocking rate	The area impacted is considered to have a very good species stocking rate. The species is known to occur in the vicinity of the pipeline corridor (ALA 2013; EcOz, 2004; Pacific Aluminium 2013). Seven individuals were recorded in earlier pipeline related work conducted by EcOz in the mid-dry season of 2004. During the 2012 ELA survey Gouldian Finches were observed at one site approximately 20 m from the pipeline centreline on two different days. On 12 November 2012, around 200 individuals were observed drinking from a small, shallow, muddy pool and (as mentioned in the 'site context' description) on 13 November 2012, a flock of 400 individuals was observed drinking at the same pool and another 100 were observed at another small pool approximately 100 m along the same creek line. Flocks were made up of approximately 60% immature/moulting individuals, 30% adult females and 10% adult males (Pacific Aluminium 2013). These numbers suggest this may be an 'important population'

COMPONENT OF QUALITY	PROPOSAL AREA ANALYSIS
	as per the EPBC Act Significant Impact Guidelines (DEWHA 2009), in that it may be a 'key source population for breeding or dispersal'. The National Recovery Plan for this species considers 'key Gouldian Finch sites' as those with populations estimated between 50-250 adults (O'Malley 2006). The Beswick/Chambers River population (of adults) is approximately the same size as that observed for the nearby Yinberrie Hills population.
Overall habitat quality	Very good (8)

Table 5-14: Impact and offset attributes used in offset calculator for Gouldian Finch breeding (and coincident dry season foraging) habitat offset

ATTRIBUTE	VALUE USED AND RATIONALE
Area disturbed	101 ha of breeding (and coincident dry season feeding) habitat (refer to section 4.5 of the EIS Supplement)
Time over which loss is averted (i.e. the length of the mitigation action - fire management).	10 years (based on Pacific Aluminium funding the fire management project for ten years).
Time until ecological benefit	3 years Time over which it is expected improvement in habitat quality (by one (1) habitat quality point) would occur, based on density of grasses increasing, as a result of improved fire regime. The benefit for nesting tree recruitment would not be realised within 10 years but is a longer term benefit that may further improve habitat quality. As any improvement in habitat quality as a result of nesting tree recruitment would be more than ten years, any further increase in the habitat quality value has not been considered in the calculator (limited to ten year period).
Start Quality (rating)	8 (as per Table 9)
Future Quality without offset (rating)	7 An effective decrease in habitat quality by one (1) habitat quality point without the offset is considered as a reasonable estimate to reflect the likely continued effect of frequent fires on habitat condition and species stocking rate. Fire history data indicates that the area in which the breeding (and coincident dry season foraging) habitat occurs is being subject to intensive fires on a yearly basis. The rationale for habitat value to continue to decline is that frequent fire events are likely to be decreasing cover/quality of dry season foraging grasses as well as wiping out new saplings of breeding trees, which has a longer term detrimental impact. Very little recruitment of tree species in these habitats and very few young trees and patchy grass occurrence have been observed in the field in these areas. It has been assumed that continual repeated frequent fire events with little recruitment will cause a decrease in cover of grass species required for dry season foraging and longer term decrease density of these nesting trees. In addition, the species stocking rate may be affected by the frequent fire occurrence causing loss of individuals in the resident Gouldian Finch population.
Future Quality with offset (rating)	9 It is anticipated that a decrease in the occurrence of late season intense fire events and frequency of events should allow denser cover of grass species for dry season foraging to establish. It may also increase the

	species stocking rate in the area subject to improved fire management as a result of decrease in loss of individuals during fire events. There will also be improved recruitment of tree saplings with longer term nesting benefits.
Risk of loss without offset	25% This was assessed on the current ability of land managers to clear or disturb habitat in this area. There are few limitations on ability to do this with appropriate approvals as there is no current conservation tenure.
Risk of loss with offset	25% The risk of loss with offset and without the offset are considered the same as the offset does not change the tenure of the land or its level of protection.
Confidence in establishment of offset	70% This is considered conservative taking into consideration that the implementation of this offset in the subject area is dependent on agreement with traditional owners.
Confidence in establishment of conversion quality	60% There are a number of external factors that could affect the success of the fire management program improving habitat quality such as the occurrence of uncontrollable wildfires, unexpected pest/weed infestations, conflicting land uses, and issues with management of resources.
Offset area to achieve 100% offset target	**931 ha**

5.7 THREATENED FAUNA: NORTHERN CRESTED SHRIKE-TIT (SECTION 10.8 OF DRAFT EIS)

5.7.1 Foraging habitat

No clear habitat preference has been described for the Northern Crested Shrike-tit (Woinarski 2004), however, the species has been recorded in eucalypt open forests and woodlands, such as those dominated by Bloodwood (*Eucalyptus opaca*), Darwin Box (*E. tectifica*), Roughleaf Cabbage Gum (*E. confertiflora*) and Darwin Stringybark (*E.* tetrodonta) (Higgins and Peter 2001). It has also been observed less commonly in woodlands dominated by *Terminalia* and *Melaleuca* species (Woinarski 2004). Factors that may increase the chances of the species inhabiting suitable areas include the presence of flaky-barked Bloodwood species and/or ironwood trees, areas not dominated by a thick shrub-layer, and areas that are prone to being waterlogged seasonally (DSEWPaC 2013).

5.7.2 Loss of potential habitat

In the Draft EIS, potential habitat for Northern Crested Shrike-tit was mapped at a large regional scale using species-habitat associations. It was estimated that up to 2,200 ha of potential Northern Crested Shrike-tit foraging and/or nesting habitat would be expected to be disturbed through vegetation clearing in the project area including for ancillary infrastructure and access roads (of which 1,800 ha was attributed to construction of the ROW). Detailed vegetation mapping of the ROW (see section 4.1 of this EIS Supplement) has allowed for finer scale analysis as follows.

Although little is known about the ecology and distribution of the Northern Crested Shrike-tit, vegetation mapping of the KGGP corridor suggests it may contain large areas of suitable foraging habitat. Woinarski (2004) identifies an area around 100 km west and south of Katherine as having potentially important populations. In order to map the potential habitat of the Northern Crested Shrike-tit along the proposed KGGP, suitability ratings were applied to vegetation units (Table 5-15), followed by spatial weightings for areas <120 km and >120 km from Katherine (Table 5-16). As records are concentrated in a 100 km area near Katherine (Woinarski 2004), a 120 km spatial weighting was applied to include this area and a 20 km buffer to absorb the township.

Table 5-15: Northern Crested Shrike-tit habitat suitability ratings of vegetation units along the pipeline corridor.

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
A	Acacia closed forest
	Acacia forest
	Acacia open forest
	Acacia open woodland
	Acacia woodland
	Callitris tall woodland
	Canarium (mixed) closed forest
	Casuarina closed forest
	Casuarina woodland
	Corymbia forest
	Corymbia open forest
	Corymbia open woodland
	Corymbia tall open woodland

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
	Corymbia woodland
	Erythrophleum variable open woodland
	Eucalyptus closed forest
	Eucalyptus forest
	Eucalyptus open forest
	Eucalyptus open woodland
	Eucalyptus tall open forest
	Eucalyptus tall woodland
	Eucalyptus woodland
	Lophostemon closed forest
	Lophostemon open forest
	Lophostemon open woodland
	Lophostemon woodland
	Melaleuca closed forest
	Melaleuca forest
	Melaleuca open forest
	Melaleuca open woodland
	Melaleuca tall forest
	Melaleuca tall open forest
	Melaleuca tall open woodland
	Melaleuca woodland
	Mixed species open woodland
	Vine forest
	Vine thicket
B	Melaleuca low open forest
	Melaleuca low open woodland
	Melaleuca low woodland
C	Acacia and Grevillea low woodland
	Aristida grassland
	Avicennia closed forest
	Beach
	Ceriops low closed forest
	Corymbia low open forest
	Corymbia low open woodland
	Corymbia low woodland
	Eriachne grassland
	Erythrophleum low open woodland
	Eucalyptus low forest

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
	Eucalyptus low open forest
	Eucalyptus low open woodland
	Eucalyptus low woodland
	Halosarcia low sparse samphire shrubland
	Heteropogon grassland
	Heteropogon open grassland
	Mixed tussock grassland/sedgeland
	Pastoral / Horticultural / Roads / Developed
	Petalostigma pubescens low woodland
	Platyzoma swamp
	Rhizophora closed forest
	Sandstone shrubland
	Sparse shrubland
	Tussock grassland
	Water

Table 5-16: Spatial weightings for potential Northern Crested Shrike-tit habitat

VEGETATION HABITAT SUITABILITY RATING	SPATIAL WEIGHTING (DISTANCE FROM KATHERINE)	
	<120 km	>120 km
A	High	Moderate
B	Moderate	Low
C	Low	Low

Results of this spatial analysis indicate that approximately 272 ha of High suitability vegetation for Northern Crested Shrike-tit (potential foraging region near Katherine) would be cleared for the ROW (Figure 5-15 and Table 5-17). This would result in this potential foraging habitat (High suitability woodland) becoming Low potential foraging habitat (open habitat) as a result of the removal of the tall trees and replacement by grasses (refer to ratings in Table 5-15 and Table 5-16). Over time, 60% of the impact area is anticipated to return to woody native vegetation (see Chapter 2 of the Draft EIS) and subsequently to its pre-clearing form and value. Residual impacts on High suitability vegetation for Northern Crested Shrike-tit (potential foraging) are therefore expected to be 109 ha

The spatial analysis also indicates that 1,264 ha of Moderate suitability vegetation for Northern Crested Shrike-tit (potential foraging) would be cleared for the ROW. Post construction, this area would be initially classed as Low suitability foraging habitat until 60% of the ROW returns to woody native vegetation and subsequently to its pre-clearing form and value. Residual impacts on Moderate suitability vegetation for Northern Crested Shrike-tit (potential foraging) are therefore expected to be 506 ha.

Table 5-17: Clearing of potentially suitable habitat for Northern Crested Shrike-tit within the ROW.

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	272	15
Moderate	1,264	70
Low	272	15
Total	1808	100

5.7.3 Assessment of potential impact, mitigation and residual impact

Section 10.8 of the Draft EIS provided a detailed impact analysis regarding the Northern Crested Shrike-tit. The key conclusions were as follows:

- Suitable habitat for the species is broadly represented in the vicinity of the project area and the wider region.
- The KGGP Project has the potential to directly impact the Northern Crested Shrike-tit through the destruction or disturbance of habitat, or by reducing prey availability from:
  - Vegetation clearing and habitat removal.
  - Change to fire regimes.
  - Introduction/spread of invasive weeds.
  - Noise and vibration causing changes in behaviour (i.e. causing adults to abandon nest).
- Potential habitat for the species is not confined to the project area, and extends across the Top End
- The proposed clearing is a small proportion of the likely fragmented, yet broad distribution of the Northern Crested Shrike-tit.
- Habitat to be cleared within the project area is unlikely to be locally or regionally significant and represents a small proportion of the habitat available for the species.
- Mitigation measures will focus on surveying for nest sites prior to construction, and in the event of a nest site being present, buffers and other management measures will be put in place.
- The construction and operation of the KGGP will be consistent with the National Multi-species Recovery Plan (inclusive of Northern Crested Shrike-tit) (Woinarski 2004).

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a), offsets are not required where the residual impact on Matters of NES is not likely to be significant (with reference to the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009)).

The additional vegetation / habitat analysis conducted and presented in this EIS Supplement indicates a lower predicted residual impact on potential high and moderate suitability vegetation for Northern Crested Shrike-tit than predicted in the Draft EIS. Additional commitments allowing for reduced working width when clearing the ROW in areas of high habitat value (see section 3.4 of this EIS Supplement) would further reduce disturbance to suitable vegetation for the Northern Crested Shrike-tit. Further, the species was recorded in 2012 surveys at a location in proximity to a power easement, suggesting a level of tolerance to disturbance.

The additional analysis and commitments in the EIS Supplement confirm and strengthen the conclusions presented in the Draft EIS regarding the Northern Crested Shrike-tit. With the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the KGGP Project on the Northern Crested Shrike-tit is unlikely to be significant based on the information that is currently available. As such, offsets relating to the Northern Crested Shrike-tit would not be required under the Commonwealth offsets policy.

5.7.4 Alternate tie-in alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-18.

Approximately half (25 ha) of the vegetation clearing would impact on High suitability vegetation for Northern Crested Shrike-tit (potential foraging region near Katherine). This represents a small proportion of the overall vegetation assessed in this category for whole of the ROW. The conclusions presented above in respect of the Northern Crested Shrike-tit would not therefore be significantly different, should this option be implemented.

Table 5-18: Clearing of potentially suitable habitat for Northern Crested Shrike-tit within the ROW for the alternative tie-in alignment

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	25	50
Moderate	0	0
Low	25	50
Total	50	100

5.7.5 Alternative Mitchell Ranges alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-19. No High suitability vegetation for the Northern Crested Shrike-tit (potential foraging near Katherine) would be removed to establish the ROW the alternative alignment. The majority of pipeline realignment (152 ha, 73%) provides Moderate suitability vegetation for Northern Crested Shrike-tit (potential foraging). This is consistent with the percentage across the whole of the ROW (current alignment) and does not change the overall conclusions of the analysis. It is unlikely that the outcomes for the Northern Masked Owl would be significantly different, should this realignment option be implemented.

Table 5-19: Clearing of potentially suitable habitat for Northern Crested Shrike-tit within the ROW for the alternative Mitchell Ranges alignment

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	0	0
Moderate	152	73
Low	56	27
Total	208	100

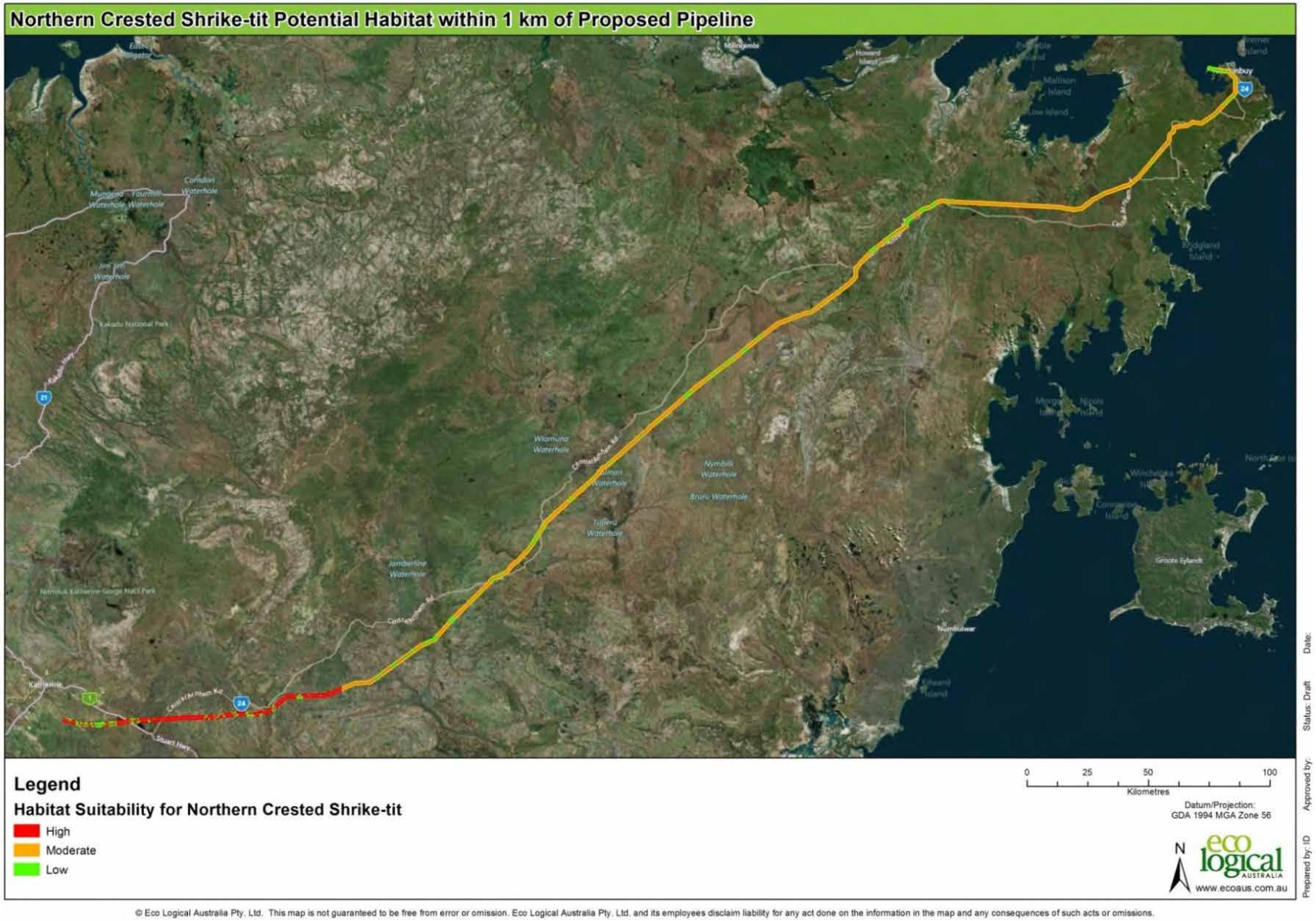


Figure 5-15: Northern Crested Shrike-tit potential habitat showing suitability ratings for foraging

5.8 THREATENED FAUNA: NORTHERN MASKED OWL (SECTION 10.10 OF DRAFT EIS)

5.8.1 Nesting and foraging habitat

The Northern Masked Owl is a subspecies of the Masked Owl (*Tyto novaehollandiae*). Little is known of the distribution of the Northern Masked Owl, and three subpopulations have been suggested: the Kimberley region of WA, the Top End of the NT and Cape York in far north QLD. In northern Australia, the Northern Masked Owl has been recorded from riparian forest, rainforest, open forest, *Melaleuca* swamps, edges of mangroves, open vegetation including grasslands, and in ecotones between open country and woodland (DSEWPaC 2013; Higgins 1999; Woinarski and Ward 2012).

The Northern Masked Owl breeds between March and October, typically nesting in tree hollows, within patches of closed forest (DSEWPaC 2013), and favours eucalypt tall open forests dominated by Darwin Woollybutt (*Eucalytus miniata*) and Darwin Stringybark (*E. tetrodonta*) (Woinarski and Ward 2012), although it may roost in dense foliage (Higgins 1993). The Northern Masked Owl feeds in open woodland on small to medium-sized terrestrial mammals up to the size of possums (DSEWPaC 2013; Higgins 1993). Although there is no detailed information for this subspecies, Masked Owls of other subspecies occupy home ranges of approximately 5-10 km^2, and have been recorded foraging up to 5 km from the nest or centre of home range (Woinarski and Ward 2012; Higgins 1993)

Although the reason for the low population density of the Northern Masked Owl (northern) is unknown, the subspecies has undoubtedly been affected by broad-scale changes to the environment of northern Australia caused by altered fire regimes, grazing by livestock and feral animals and the invasion of native woodlands by exotic plants, particularly introduced pasture grasses. There is some evidence of a broad-scale decline in the numbers of small and medium-sized endemic mammals across northern Australia over the last century (DSEWPAC 2013). This may have reduced food availability for Northern Masked Owls (Woinarski 2004).

5.8.2 Loss of potential habitat

In the Draft EIS, it was estimated that up to 2,200 ha of potential Northern Masked Owl foraging and/or nesting habitat would be expected to be disturbed through vegetation clearing in the project area including for ancillary infrastructure and access roads (of which 1,800 ha was attributed to construction of the ROW). Detailed vegetation mapping of the ROW (see section 4.1 of this EIS Supplement) has allowed for finer scale analysis as follows.

Vegetation within the KGGP corridor includes potential nesting and foraging habitat for the Northern Masked Owl. Studies described in Higgins (1999) suggest high suitability nesting vegetation is primarily large trees with hollows, and foraging habitat is a mosaic of woodland to open vegetation, mostly likely where there is an abundance of small to medium sized mammals up to 5 km from nesting sites (Higgins 1999). Given the need for water year-round for this species and the mammals it preys upon, it is likely breeding (and coincident dry season foraging) habitat is located within 5 km of perennial water in the dry season (breeding season), and potentially more dispersed within the wet season.

In order to map the potential nesting and foraging habitat of the Northern Masked Owl along the proposed KGGP, suitability ratings have been applied to vegetation units (Table 5-20), followed by spatial weightings for <5 km and >5 km from perennial water (Table 5-21). A 0.2 km buffer was added to these distances to allow for braided channels and low-resolution drainage mapping. Perennial water is identified from the Geofabric Surface Network (BOM 2011) and includes creeks attributed as

'perennial' flowing and 'major rivers/creeks' that may cease to flow but would have permanent disconnected pools. Additional perennial water features are included where known, from Gouldian Finch surveys (section 4.5 of this Supplement).

Table 5-20: Northern Masked Owl habitat suitability ratings of vegetation units along the pipeline corridor.

VEGETATION HABITAT SUITABILITY RATING	VEGETATION HABITAT (NVIS LEVEL 3)
	Acacia and Grevillea low woodland
	Acacia closed forest
	Acacia forest
	Acacia open forest
	Acacia open woodland
	Acacia woodland
	Avicennia closed forest
	Callitris tall woodland
	Canarium (mixed) closed forest
	Casuarina closed forest
	Casuarina woodland
	Ceriops low closed forest
	Corymbia forest
	Corymbia low open forest
	Corymbia low open woodland
	Corymbia low woodland
A	Corymbia open forest
	Corymbia open woodland
	Corymbia tall open woodland
	Corymbia woodland
	Erythrophleum low open woodland
	Erythrophleum variable open woodland
	Eucalyptus closed forest
	Eucalyptus forest
	Eucalyptus low forest
	Eucalyptus low open forest
	Eucalyptus low open woodland
	Eucalyptus low woodland
	Eucalyptus open forest
	Eucalyptus open woodland
	Eucalyptus tall open forest
	Eucalyptus tall woodland
	Eucalyptus woodland

VEGETATION HABITAT SUITABILITY RATING	VEGETATION HABITAT (NVIS LEVEL 3)
	Lophostemon closed forest
	Lophostemon open forest
	Lophostemon open woodland
	Lophostemon woodland
	Melaleuca closed forest
	Melaleuca forest
	Melaleuca low open forest
	Melaleuca low open woodland
	Melaleuca low woodland
	Melaleuca open forest
	Melaleuca open woodland
	Melaleuca tall forest
	Melaleuca tall open forest
	Melaleuca tall open woodland
	Melaleuca woodland
	Mixed species open woodland
	Petalostigma pubescens low woodland
	Rhizophora closed forest
	Vine forest
	Vine thicket
B	Aristida grassland
	Eriachne grassland
	Halosarcia low sparse samphire shrubland
	Heteropogon grassland
	Heteropogon open grassland
	Mixed tussock grassland/sedgeland
	Pastoral / Horticultural / Roads / Developed
	Platyzoma swamp
	Sandstone shrubland
	Sparse shrubland
	Tussock grassland
C	Beach
	Water

Table 5-21: Spatial weightings based on distance to perennial water for potential Northern Masked Owl habitat

VEGETATION HABITAT SUITABILITY RATING	SPATIAL WEIGHTING (DISTANCE FROM PERENNIAL WATER)	
	<5 km	>5 km
A	High	Moderate
B	Moderate	Low
C	Low	Low

Results of this spatial analysis indicate that approximately 1,068 ha of High suitability vegetation for Northern Masked Owl (potential nesting and foraging) would be cleared for the ROW (Figure 5-16 and Table 5-22), excluding riparian vegetation above HDD sites. This would result in this potential nesting and foraging habitat (High suitability woodland habitat) becoming solely foraging habitat as a result of the removal of the tall trees and replacement by grasses (Moderate suitability open habitat) (refer to ratings in Table 5-20 and Table 5-21). Over time, 60% of this impact area is anticipated to return to woody native vegetation (see Chapter 2 of the Draft EIS) and subsequently to its pre-clearing form and value. Residual impact on High suitability vegetation for Northern Masked Owl (potential nesting and foraging) is therefore expected to be 427 ha.

The spatial analysis also indicates that 697 ha of Moderate suitability vegetation for Northern Masked Owl (potential foraging) would be cleared for the ROW. Post-construction, this area would be initially classed as Moderate foraging habitat if within 5 km of perennial water, or be initially classed as Low suitability foraging habitat outside of this range until 60% of the ROW returns to woody native vegetation and subsequently to its pre-clearing form and value. Residual impact on Moderate suitability vegetation for Northern Masked Owl (potential foraging) is therefore expected to be 279 ha.

Table 5-22: Clearing of potentially suitable habitat for Northern Masked Owl within the ROW.

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	1,068	59
Moderate	697	39
Low	43	2
Total	1808	100

5.8.3 Assessment of potential impact, mitigation and residual impact

Section 10.10 of the Draft EIS provided a detailed impact analysis regarding the Northern Masked Owl. The key conclusions were as follows:

- Potential habitat for the species is not confined to the project area, and is likely to extend across the Top End, particularly in the northern Top End where the majority of records of this species have occurred.
- The KGGP Project has the potential to directly impact the Northern Masked Owl through the destruction or disturbance of habitat, or by reducing prey availability from:
    - Vegetation clearing and habitat removal.
    - Change to fire regimes.
    - Introduction/spread of invasive weeds.

  - Noise and vibration causing changes in behaviour (i.e. causing adults to abandon nest).
- Measures proposed to reduce impacts on tall woodland near water sources will reduce potential for unknown nest hollows in tall trees in these areas to be impacted.
- Clearing of the narrow ROW corridor is unlikely to result in habitat fragmentation, particularly given that a large portion of this will be rehabilitated.
- Habitat to be cleared within the project area is unlikely to be locally or regionally significant to the species and represents a small proportion of the habitat available for the species.
- Mitigation measures will focus on surveying for nest sites prior to construction, and avoidance where possible; and also fire management to reduce any potential change in fire regimes.
- With the proposed mitigation measures implemented, it is considered unlikely that the Northern Masked Owl will be significantly impacted as a result of the KGGP Project.
- The construction and operation of the KGGP will be consistent with the National Multi-species Recovery Plan (inclusive of Northern Masked Owl).

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a), offsets are not required where the residual impact on Matters of NES is not likely to be significant (with reference to the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009)).

The additional vegetation / habitat analysis conducted and presented in this EIS Supplement indicates a lower predicted residual impact on potential high and moderate suitability vegetation for Northern Masked Owl than predicted in the Draft EIS. Additional commitments allowing for reduced working width when clearing the ROW in areas of high habitat value (see section 3.4 of this EIS Supplement) would further reduce disturbance to suitable vegetation for the Northern Masked Owl.

The additional analysis and commitments in the EIS Supplement confirm and strengthen the conclusions presented in the Draft EIS regarding the Northern Masked Owl. With the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the KGGP Project on the Northern Masked Owl are unlikely to be significant based on the information that is currently available. As such, offsets relating to the Northern Masked Owl would not be required under the Commonwealth offsets policy.

5.8.4 Alternate tie-in alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-23.

The majority (29 ha, 58% of the ROW) of the vegetation clearing would impact Moderate suitability vegetation for Northern Masked Owl (potential foraging). The conclusions presented above regarding the Northern Masked Owl would not therefore be significantly different, should this option be implemented.

Table 5-23: Clearing of potentially suitable habitat for Northern Masked Owl within the ROW for the alternative tie-in alignment.

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	7	14
Moderate	29	58
Low	14	28
Total	50	100

5.8.5 Alternative Mitchell Ranges alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-24. High suitability vegetation for the Northern Masked Owl (potential foraging) occurs across the majority of pipeline realignment (172 ha, 82%). While this is a higher percentage than across the whole of the ROW (current alignment), it involves a very small area compared to the extent of such habitat available locally in the surrounding area and more broadly in the region. It does not change the overall conclusion because of the relatively small area involved, the habitat to be cleared is unlikely to be locally or regionally significant to the species and it represents a small proportion of the habitat available for the species. In consideration of this and the additional mitigation proposed, it is unlikely that the outcomes for the Northern Masked Owl would be significantly different, should this realignment option be implemented.

Table 5-24: Clearing of potentially suitable habitat for Northern Masked Owl within the ROW for the alternative Mitchell Ranges alignment

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	172	82
Moderate	36	17
Low	<1	<1
Total	208	100

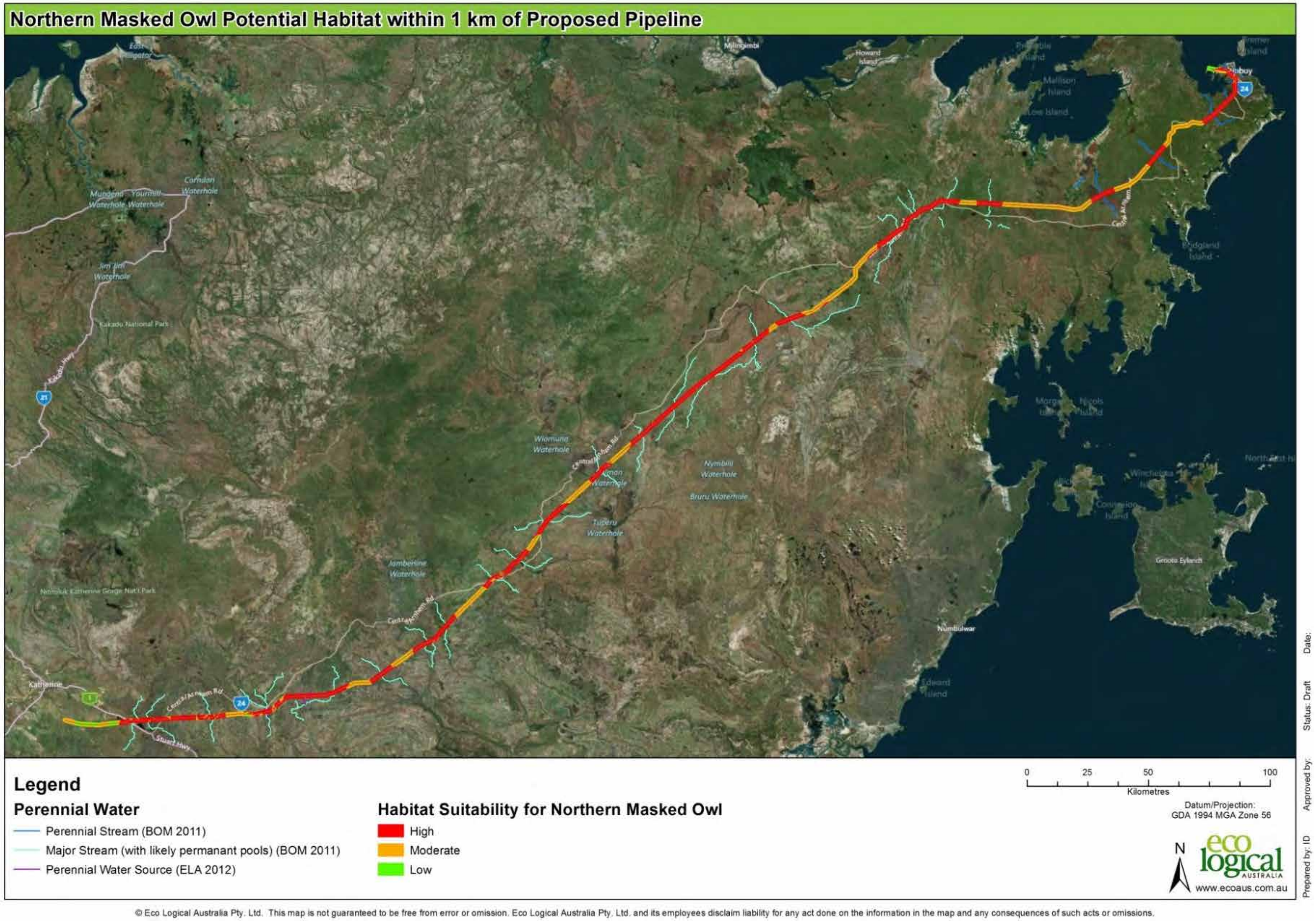


Figure 5-16: Northern Masked Owl potential habitat showing suitability ratings for nesting and foraging vegetation relative to distance from perennial water.

5.9 THEATENED FAUNA: NORTHERN QUOLL (SECTION 10.13 OF DRAFT EIS)

5.9.1 Denning and foraging habitat

Habitat for the Northern Quoll is non-specific, but includes some form of rocky area or structurally diverse woodland or forest for denning/shelter purposes, with surrounding vegetated habitats used for foraging and dispersal (DSEWPaC 2011a, DSEWPaC 2013). Their range includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (DSEWPaC 2013). Shelter sites also include rocky outcrops, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings (Hill and Ward 2010). Sandstone escarpment is considered prime habitat (Braithwaite and Griffiths 1994). Denning/shelter habitat is important for breeding, refuge from fire and/or predation, and long term viability of the species (DSEWPaC 2011a). Surveys throughout Queensland have suggested Northern Quolls are more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and close to permanent water (Woinarski *et al*. 2008).

Northern Quolls are opportunistic omnivores, consuming a wide range of prey including frogs and invertebrates, particularly beetles, grasshoppers, spiders and centipedes, but they also eat fruits of at least nine species of plants (DSEWPaC 2013). Female quolls have been radio-tracked in Kakadu National Park to forage within a home range of approximately 35 ha. Males are thought to have a similar home range in the non-breeding season, but utilise triple this area to maximise encounters with mates (Oakwood 2002).

5.9.2 Loss of potential habitat

In the Draft EIS it was estimated that clearing for construction of the ROW would result in the removal of approximately 1,232 ha of potential denning/shelter habitat in the form of forest and woodland. Detailed vegetation mapping of the ROW (see section 4.1 of this EIS Supplement) has allowed for finer scale analysis as follows.

Vegetation within the KGGP corridor includes potential denning and foraging habitat for the Northern Quoll. Although the quolls have non-specific habitat, their denning, sheltering and foraging habitat utilises vegetation communities with larger trees that produce hollows and logs, and rocky areas that are protected from fire and predators. Woinarski *et al*. (2008) also suggests quolls are more abundant near permanent water.

It is difficult to map small-scale features such as rocky outcrops and small permanent water sources within the landscape (e.g. small springs and subterranean pools). However, these features would occur within many of the vegetation units that also have medium to large sized trees. Therefore, to map the potential habitat of the Northern Quoll along the proposed KGGP, vegetation units were rated primarily against vegetation structure (Table 5-25) and proximity to known perennial water (Table 5-26). A distance of 5 km from permanent water caters for numerous home ranges of Northern Quolls. It also assumes small tributaries with permanent pools may occur near confluences with larger perennial streams, thereby broadening the ‘close-to-water’ habitat. A 0.2 km buffer was added to these distances to allow for braided channels and low-resolution drainage mapping. Perennial water is identified from the Geofabric Surface Network (BOM 2011) and includes creeks attributed as ‘perennial’ flowing and ‘major rivers/creeks’ that may cease to flow but would have permanent disconnected pools. Additional perennial water features are included where known, from Gouldian Finch surveys (section 4.5 of this Supplement). It is acknowledged that additional dry-season water sources may occur elsewhere, and therefore tree-dominated habitat further than 5 km is rated as Moderate suitability for Northern Quolls.

Table 5-25: Northern Quoll habitat suitability ratings of vegetation units along the pipeline corridor.

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
A	Acacia closed forest
	Acacia forest
	Acacia open forest
	Acacia open woodland
	Acacia woodland
	Callitris tall woodland
	Canarium (mixed) closed forest
	Casuarina closed forest
	Casuarina woodland
	Corymbia forest
	Corymbia open forest
	Corymbia open woodland
	Corymbia tall open woodland
	Corymbia woodland
	Erythrophleum variable open woodland
	Eucalyptus closed forest
	Eucalyptus forest
	Eucalyptus open forest
	Eucalyptus open woodland
	Eucalyptus tall open forest
	Eucalyptus tall woodland
	Eucalyptus woodland
	Lophostemon closed forest
	Lophostemon open forest
	Lophostemon open woodland
	Lophostemon woodland
	Melaleuca closed forest
	Melaleuca forest
	Melaleuca open forest
	Melaleuca open woodland
	Melaleuca tall forest
	Melaleuca tall open forest
	Melaleuca tall open woodland
	Melaleuca woodland
	Mixed species open woodland
	Vine forest
	Vine thicket

VEGETATION HABITAT SUITABILITY RATING	VEGETATION UNIT (NVIS LEVEL 3)
B	Acacia and Grevillea low woodland
	Corymbia low open forest
	Corymbia low open woodland
	Corymbia low woodland
	Erythrophleum low open woodland
	Eucalyptus low forest
	Eucalyptus low open forest
	Eucalyptus low open woodland
	Eucalyptus low woodland
	Melaleuca low open forest
	Melaleuca low open woodland
	Melaleuca low woodland
	Pastoral / Horticultural / Roads / Developed
	Petalostigma pubescens low woodland
	Sandstone shrubland
	Water
C	Aristida grassland
	Avicennia closed forest
	Beach
	Ceriops low closed forest
	Eriachne grassland
	Halosarcia low sparse samphire shrubland
	Heteropogon grassland
	Heteropogon open grassland
	Mixed tussock grassland/sedgeland
	Platyzoma swamp
	Rhizophora closed forest
	Sparse shrubland
	Tussock grassland

Table 5-26: Spatial weightings for potential Northern Quoll habitat

VEGETATION HABITAT SUITABILITY RATING	SPATIAL WEIGHTING (DISTANCE FROM PERENNIAL WATER)	
	<5 km	>5 km
A	High	Moderate
B	Moderate	Low
C	Low	Low

Results of this spatial analysis identify that approximately 915 ha of High suitability vegetation for Northern Quoll (potential denning and foraging) would be cleared for the ROW (Figure 5-17 and Table 5-27), excluding riparian vegetation above HDD sites. This would result in this potential denning and foraging habitat (High suitability woodland habitat) becoming foraging habitat as a result of the removal of the tall trees and replacement by grasses (Low suitability open foraging habitat), (refers ratings in Table 5-25 and Table 5-26). Over time, 60% of this impact area is anticipated to return to woody native vegetation (see Chapter 2 of the Draft EIS) and subsequently to its pre-clearing form and value. Residual impacts on High suitability vegetation for Northern Quoll (potential denning and foraging) are therefore expected to be 366 ha.

The spatial analysis also indicates that 780 ha of Moderate suitability vegetation for Northern Quoll (potential foraging) would be cleared for the ROW. Post-construction, this area would be initially classed Low suitability foraging habitat until 60% of the ROW returns to woody native vegetation and subsequently to its pre-clearing form and value. Residual impacts on Moderate suitability vegetation for Northern Quoll (potential foraging) are therefore expected to be 312 ha.

Table 5-27: Clearing of potentially suitable habitat for Northern Quoll within the ROW

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	915	51
Moderate	780	43
Low	113	6
Total	1,808	100

5.9.3 Assessment of potential impact, mitigation and residual impact

Section 10.13 of the Draft EIS provided a detailed impact analysis regarding the Northern Quoll. The key conclusions were as follows:

- The recent decline of small mammals in the Top End, NT, including the Northern Quoll, has affected the density and distribution of populations across the region.
- Given that there is only a single record from the last 20 years within 100 km of the pipeline centreline and that the project area does not contain any particular habitat or shelter that is different from the surrounding region, it is considered highly unlikely that a significant population occurs. At best, a sparse distribution and very low density of the species may occur within the region surrounding the pipeline alignment.
- The woodland and forest habitat within the pipeline corridor that could be potential denning/shelter habitat critical to the survival of the species, is considered to be of relatively low conservation importance for the Northern Quoll based on the following reasons:
    - The close proximity of Kakadu National Park (and other protected areas) which contains extensive areas considered to represent habitat critical to the survival of the Northern Quoll and where the species has been recorded more recently.
    - The low historical density of the species in the region traversed by the KGGP and its otherwise higher historical density in regions in the north-west of the Top End.
    - The absence of observations of the species during recent surveys within the project area.

- Despite the very low probability of occurrence of the Northern Quoll, potential habitat does occur within the project area
- If the species were to occur, the KGGP project could affect the Northern Quoll from the following potential impacts:
  - Clearing of habitat during the construction of the pipeline.
  - Mortality and injury of individuals from encounters with vehicles and machinery during trenching, construction and operations.
  - Injuries or mortalities of individuals from trench fall (during open pipeline trenching).
  - Invasion and spread of feral animals and weed species.
  - Increased risk of fire through ignition sources.
  - Spread of weed species that yield greater fuel loads for fires.
- Fragmentation of the local population is unlikely as there is no evidence to suggest individuals utilise even the most suitable habitat within the project area such as the forests and woodlands.
- Suitable habitat is considered widespread and common across the region.
- The Cane Toad (identified as a key threat to the Northern Quoll in Woinarski *et al*. 2010) is likely to have already severely impacted any populations that may have historically or potentially occurred within the region traversed by the KGGP.

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a), offsets are not required where the residual impact on Matters of NES is not likely to be significant (with reference to the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009)). The Draft EIS concluded that there is little potential for a significant residual impact from the construction and operation of the Project on the Northern Quoll based on the information that is currently available.

The additional vegetation / habitat analysis conducted and presented in this EIS Supplement indicates a lower predicted residual impact on potential high and moderate suitability vegetation for Northern Quoll than predicted in the Draft EIS. Additional commitments allowing for reduced working width when clearing the ROW in areas of high habitat value (see section 4.1 of this EIS Supplement and commitment to minimise the clearing of tall woodland near permanent water in Table 10-5 of the Draft EIS) would further reduce disturbance to suitable vegetation for the Northern Quoll. The species is very unlikely to occur in the project area however, Pacific Aluminium acknowledges that any occurrence would be highly significant. Accordingly, the potential for mortality or injury from trench fall is considered to be the key risk to managed and additional fauna handling protocols and detail on trenching has been provided in this EIS Supplement (see section 6.2.10 and Appendix D).

The additional analysis and commitments in the EIS Supplement confirm and strengthen the conclusions presented in the Draft EIS regarding the Northern Quoll. With the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the KGGP Project on the Northern Quoll are unlikely to be significant based on the information that is currently available. As such, offsets relating to the Northern Quoll would not be required under the Commonwealth offsets policy.

5.9.4 Alternate tie-in alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-28.

Almost half (24 ha) of the vegetation clearing would impact Moderate suitability vegetation for Northern Quoll (potential foraging). A smaller proportion (7 ha, 15%) of High suitability vegetation for Northern Quoll (potential denning and foraging) would be cleared. The conclusions presented above regarding the Northern Quoll would not therefore be significantly different, should this option be implemented.

Table 5-28: Clearing of potentially suitable habitat for Northern Quoll within the ROW for the alternative tie-in alignment

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	7	15
Moderate	24	48
Low	19	37
Total	50	100

5.9.5 Alternative Mitchell Ranges alignment

The spatial analysis described above was applied to the vegetation mapping for the alternative tie-in alignment and the results are presented in Table 5-29. High suitability vegetation for the Northern Quoll (potential denning and foraging) occurs across the majority of pipeline realignment (118 ha, 57%). This is consistent with the vegetation analysis across the whole of the ROW (current alignment) and it is unlikely that the outcomes for the Northern Quoll would be significantly different, should this realignment option be implemented.

Table 5-29: Clearing of potentially suitable habitat for Northern Quoll within the ROW for the alternative Mitchell Ranges alignment

HABITAT SUITABILITY RATING	AREA (ha) TO BE CLEARED WITHIN 30 M ROW	% TO BE CLEARED WITHIN 30 M ROW
High	118	57
Moderate	88	42
Low	2	1.
Total	208	100

Figure 5-17: Northern Quoll potential habitat showing suitability ratings for denning and foraging vegetation relative to distance from perennial water.

5.10 THREATENED FAUNA: FRESHWATER SAWFISH

The Freshwater Sawfish (*Pristis microdon*) is listed as Vulnerable under both the EPBC Act and the TPWC Act. Impact analysis for this species was provided in section 10.14 of the Draft EIS.

Additional mitigation regarding this species has been proposed in sections 6.2.3 and 6.2.5 of this EIS Supplement and includes:

- A specific Risk Assessment and Adaptive Management approach to crossing watercourses that potentially provide habitat for Freshwater Sawfish, including on-site assessment by an independent Freshwater Sawfish expert and the option of deferral of construction until the crossing is dry.
- No water extraction from refuge pools.
- Where water extraction is proposed from watercourses that are in flow and potentially provide habitat for Freshwater Sawfish, site specific hydrological assessment informed by the advice of an independent Freshwater Sawfish expert will be undertaken, as part of the Water Supply and Adaptive Management Strategy. The assessment will determine the appropriate stop points for water extraction to enable water levels sufficient for continued fish passage along the watercourse.

The Draft EIS concluded that construction and operation of the KGGP is not anticipated to have any significant impacts on the Freshwater Sawfish. With the additional mitigation proposed above, this conclusion is strengthened.

5.11 THREATENED FAUNA: MERTENS WATER MONITOR AND MITCHELL'S WATER MONITOR

Merten's Water Monitor and Mitchell's Water Monitor are listed as Vulnerable under the TPWC Act but are not protected under the Commonwealth EPBC Act.

5.11.1 Ecology

Merten's Water Monitor (*Varanus mertensi*) reaches a greater size than Mitchell's Water Monitor (*Varanus mitchelli*) and occurs further east across northern Queensland, but the two species share very similar ecology. They are both arboreal and semi-aquatic, foraging extensively in water. Both species have laterally compressed tails and will drop into the water when disturbed. Mitchell's Water Monitor is more arboreal sheltering in waterside vegetation, while Merten's Water Monitor is more strongly aquatic, basking on partly submerged rocks and logs (Cogger 2000, Wilson and Knowles 1988).

5.11.2 Survey Methods

Adult water monitors are unlikely to be captured by standard trapping programs, and diurnal and nocturnal active searches around permanent waterholes with dense surrounding vegetation are the most effective survey method. For creeks and rivers, surveys conducted by boat may be most effective (Doody *et al*. 2009). During the 2012 KGGP terrestrial fauna survey, two Spotted Tree Monitors (*Varanus scalaris*) were recorded by remote cameras, suggesting that cameras deployed in suitable habitat may also be useful for surveying for Water Monitors.

Merten's and Mitchell's Water monitors were not specifically targeted by any of the fauna surveys associated with the KGGP project; however, some of the methods and locations would have been suitable for detecting Water Monitors.

The 2003 – 2004 aquatic fauna survey incorporated opportunities for incidental observations while conducting aquatic surveys from the waters' edge along rivers, creeks and billabongs. The 2004 terrestrial fauna survey included some traplines deployed adjacent to riverine vegetation at Latram River and Goromuru River. Although 2012 fauna surveys were designed to target threatened bird and mammal species, many dawn surveys and evening spotlight surveys in the area east of Beswick were conducted around suitable permanent billabongs with dense bordering vegetation. The 2013 terrestrial fauna survey in the previously unsurveyed area to the north of the Mitchell Ranges included two traplines within suitable riparian vegetation.

5.11.3 2004, 2012 and 2013 KGGP fauna survey results

Mitchell's Water Monitor was not recorded by any of the surveys in the pipeline area and there are no historical records of the species in the area (Ward 2012).

Merten's Water Monitors were recorded during the 2003 - 2004 aquatic fauna survey at Mainoru, Barmguerikba Creek and Wonga Creek, and during the 2013 survey along a tributary of Badalngarrmim Creek.

5.11.4 Assessment of potential impact

The primary conservation concern for Water Monitors in the Northern Territory is the impact of Cane Toads (*Rhinella marinus*). Declines in the abundance of Merten's and Mitchell's water monitors of 71 – 97% were recorded in the Daly River following the arrival of Cane Toads in the area between 2001 and 2007 (Doody *et al.* 2009). Declines have also been documented for Merten's Water Monitor at Manton Dam Recreation Area, 70 km south of Darwin (Griffiths and McKay 2007) and in Kakadu National Park (Burnett 1997).

Water Monitor populations that have already been impacted by Cane Toads may be more sensitive to other disturbances including:

- Clearing of habitat.
- Disturbance of nesting chambers in waterway banks.
- Predation by feral cats on young or eggs.

Given their reliance on aquatic habitats and surrounding dense vegetation, the potential impact of KGGP construction and operation on Water Monitors will largely be mitigated by methods implemented to minimise impacts at water crossings. During the earliest phases of the project, avoidance of disturbance to water crossings was a key factor in route selection. The use of HDD at nine major watercourse crossings and the additional risk assessment and adaptive management process for watercourse crossings (detailed in section 6.2.3 of this EIS Supplement) will ensure disturbance of in-stream habitat will be avoided or minimised. Mitigation measures for watercourse crossings are also set out in Appendix O (EMP) of the Draft EIS.

The potential for mortality or injury from trench fall is also a risk to be managed for these species and additional fauna handling protocols and detail on trenching has been provided in this EIS Supplement (see section 6.2.10 and Appendix D).

As indicated for terrestrial fauna generally (Draft EIS, section 9.1.4), after mitigation is applied construction and operation of the KGGP are expected to have a low impact on the Merten's Water Monitor and Mitchell's Water Monitor.

5.12 THREATENED FAUNA: YELLOW-SPOTTED MONITOR

The Yellow Spotted Monitor is listed as Vulnerable under the TPWC Act and not listed under the EPBC Act.

5.12.1 Ecology

The Yellow-spotted Monitor (*Varanus panoptes*) is larger than Merten's and Mitchell's Water Monitors. The species is terrestrial and forages across a range of habitats from coastal areas, grassland, floodplains and woodland. Burrows are excavated at the base of dense vegetation or beneath boulders (Cogger 2000, Wilson and Knowles 1988).

5.12.2 Survey Methods

Yellow-spotted Monitors, at 1.4 m length, are unlikely to be captured by standard trapping programs, and diurnal active searching is the most effective survey method. During the 2012 KGGP terrestrial fauna survey, two Spotted Tree Monitors (*Varanus scalaris*) were recorded by remote cameras, suggesting that cameras deployed in suitable habitat may also be useful for surveying for Yellow-spotted Monitors, although given the diversity of habitats used, targeting suitable areas may be difficult.

Yellow-Spotted Monitors were not specifically targeted by any of the fauna surveys associated with the KGGP project, but some surveys did take place in suitable habitat and there were opportunities for incidental observations of the species.

5.12.3 Survey results

Yellow-spotted monitors were not observed during any of the fauna surveys associated with the KGGP project, and historical records of the species are limited to the area near Katherine, and the Gove Peninsula (Ward *et al.* 2012).

5.12.4 Assessment of potential impact

The primary conservation concern for the Yellow-spotted Monitor in the Northern Territory is the impact of Cane Toads (*Rhinella marinus*). Declines in the abundance of Yellow-spotted monitors of 83 - 96% were recorded in the Daly River following the arrival of Cane Toads in the area between 2001 and 2007 (Doody *et al*. 2009). Declines related to Cane Toads have also been recorded in three widely distributed areas of northern Queensland (Burnett 1997).

Although Cane Toads are the major conservation concern for the species, populations that have already been impacted may be more sensitive to other disturbance including:

- Clearing of habitat.
- Predation by feral cats on young or eggs.
- Changes to fire regimes.

Chapters 9 and 10 and Appendix O in the Draft EIS address the assessment of potential impacts from these factors arising from the KGGP Project and their proposed management.

The potential for mortality or injury from trench fall is considered to be the key risk to be managed for this species and a fauna handling protocol has been provided in this EIS Supplement (see section 6.2.10 and Appendix D).

As indicated for terrestrial fauna generally (Draft EIS, section 9.1.4), after mitigation is applied construction and operation of the KGGP are expected to have a low impact on the Yellow-spotted Monitor.

5.13 THREATENED FAUNA: BARE-RUMPED SHEATHTAIL BAT

The Bare-rumped Sheathtail Bat is listed as Critically Endangered under the EPBC Act.

The national assessment of Critically Endangered was based on the apparent absence of recent records from its relatively small known historic range in north eastern Queensland, associated with substantial vegetation clearance in that region (Woinarski and Milne 2006).

The species' status in the Northern Territory has been very difficult to assign given the very few records, no information from which to consider trends in status, and no obvious threatening process. While the known range is currently very limited, this may reflect sampling problems (Woinarski and Milne 2006). The species is therefore considered Data Deficient under the TPWC Act.

5.13.1 Ecology and distribution

Australian populations of the Bare-rumped Sheathtail Bat are extremely poorly-known and individuals are infrequently recorded. This may be an artifact of the difficultly of determining their presence by acoustics recordings or mist nests, or may reflect an actual limited distribution and abundance of the species.

The apparently disjunct distribution includes an eastern population occurring in a narrow coastal band from approximately Townsville through to north eastern Cape York, including Magnetic Island, and a population in the Northern Territory seemingly restricted to the Kakadu lowlands and the Darwin region (Figure 5-18) (Schulz and Thompson 2007). Known populations in the NT are a minimum of 220 km from the pipeline corridor (Figure 5-19).

The Bare-rumped Sheathtail Bat is insectivorous, foraging for insects above the woodland or forest canopy. No information is available on seasonal or breeding movements (Schulz and Thompson 2007).

The species was first recorded in the Northern Territory in 1979 and there have been very few records since (McKean *et al*. 1981; Thomson 1991 in Woinarski and Milne 2006). All confirmed records in the Northern Territory have been from the Kakadu lowlands (Woinarski and Milne 2006) in areas of open *Pandanus* woodland fringing the sedgelands of the South Alligator River in Kakadu National Park (Friend and Braithwaite 1986 in Woinarski and Milne 2006). In the Northern Territory, it has also been recorded from eucalypt tall open forests (Churchill 1998 in Woinarski and Milne 2006).

In Australia, all confirmed roosting records are from deep tree hollows in the Poplar Gum *Eucalyptus platyphylla*, Darwin Woollybutt *E. miniata* and Darwin Stringybark *E. tetrodonta* (McKean et al. 1981; Compton and Johnson 1983; Churchill 1998; Murphy 2002 in Woinarski and Milne 2006). Hollows in these tree species have also been used as maternity roosts (Woinarski and Milne 2006).

Figure 5-18: Distribution of Bare-rumped Sheathtail Bat (Churchill (1998) in Schulz and Thompson [2007])

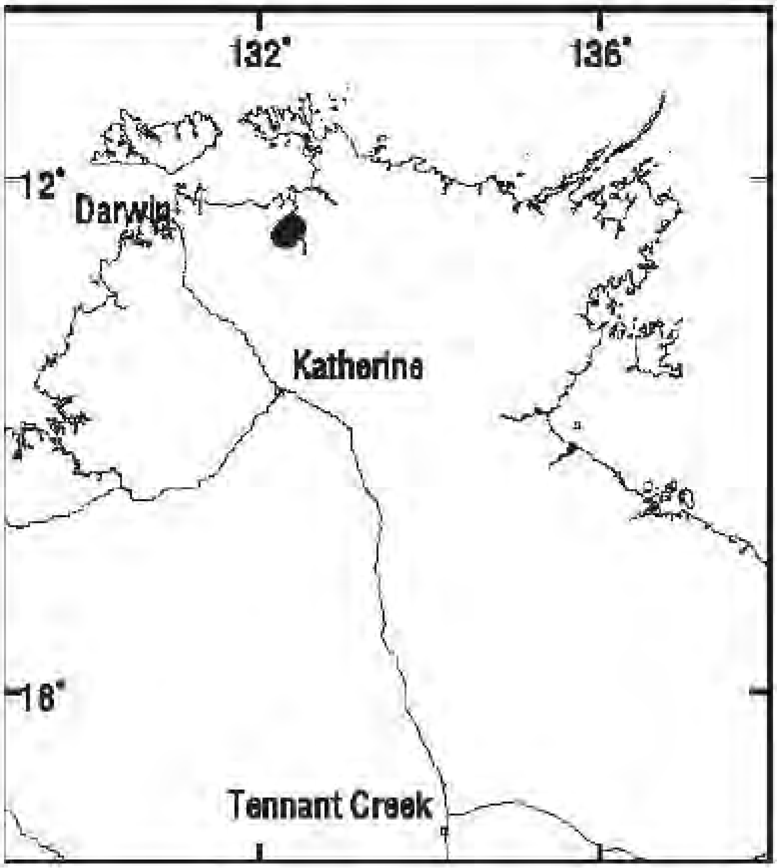


Figure 5-19: Records of Bare-rumped Sheath-tailed Bat from the Northern Territory post 1970 (Woinarski and Milne 2006)

5.13.2 Survey

Bare-rumped Sheathtail Bats cannot currently be reliably identified from acoustic recordings so must be identified based on morphology following capture (although an approach based on newer full spectrum acoustic information is under development, pers. comm. Dr Kyle Armstrong, Specialised Zoological 17/07/2013). As the species forages primarily for aerial insects over the woodland/forest canopy, mist nests need to be deployed at or above the canopy to be effective. This technique requires intensive effort to deploy and effectively monitor and would not be a suitable survey technique for the large project area, which is a significant distance (minimum of 220 km) from any known populations.

Given the combination of unlikely occurrence and difficultly of detection, the Bare-rumped Sheathtail Bat was not targeted in the 2004, 2012 or 2013 terrestrial fauna surveys.

Habitat modeling has not been possible in the Northern Territory because of the low number of records (Schulz and Thompson 2007)

5.13.3 Assessment of potential impact

The National Recovery Plan for the Bare-rumped Sheathtail Bat lists the following key threats to this species:

- Vegetation change.
- Timber collection and targeted tree removal.
- Competition for hollows.
- Disease.
- Climate change.

The majority of vegetation to be cleared to establish the ROW would comprise *Eucalyptus* woodlands, *Eucalyptus* open forest and *Eucalyptus* open woodland vegetation communities. These vegetation communities are common in the surrounding region (see section 5.1 of this EIS Supplement). Large trees (potentially containing roosting hollows) would be avoided or removal minimised (when avoidance is not possible) when selecting the alignment of the ROW within the pipeline corridor (see section 3.4 of this EIS Supplement). Implementation of the KGGP Project is unlikely to exacerbate the other threats identified for the species in the Species Recovery Plan.

Given the very low likelihood of the occurrence of this species in the pipeline region (with historical records well to the north), wide availability of affected vegetation communities (providing possible foraging habitat) in the surrounding region and mitigation measures to avoid or minimise removal of potential roosting trees, significant impacts on the Bare-rumped Sheathtail Bat are unlikely.

5.14 FAUNA AND FLORA IMPACTS: UNSURVEYED AREA NORTH OF MITCHELL RANGES (KP399-435)

5.14.1 Introduction

Section 4.2 of this EIS Supplement described the results of additional flora and fauna survey in the vicinity of a section of the proposed pipeline alignment to the north of the Mitchell Ranges that had not been surveyed prior to preparation of the Draft EIS. The flora survey did not record any threatened species. The fauna survey recorded the threatened Merten's Water Monitor *Varanus mertensi* (Vulnerable under the NT TPWC Act) and the Rainbow Bee-eater *Merops ornatus* (EPBC Act migratory). None of the target threatened fauna species were recorded: Melville Cicadabird (*Coracina tenuirostris melvillensis*); Northern Crested Shrike-tit (*Falcunculus frontatus whitei*); Red Goshawk (*Erythrotriorchis radiatus*); Brush-tailed Tree Rat (*Conilurus penicillatus*); Northern Brush-tailed Phascogale (*Phascogale pirata*); or Northern Quoll (*Dasyurus hallucatus*).

5.14.2 Assessment of potential impact

Additional impact analysis for species comprising Matters of NES presented in sections 5.5 to 5.9 of this EIS Supplement was inclusive of the vegetation communities found in the previously unsurveyed area. The absence of any targeted MNES species during the survey supports the conclusions of the additional impact analysis undertaken. With the exception of the Gouldian Finch, this analysis (and that of the Draft EIS) concluded that, with the implementation of the proposed mitigation measures, significant residual impacts on Matters of NES are unlikely.

The Draft EIS also made conclusions regarding predicted environmental outcomes for vegetation / flora and fauna more generally. After mitigation is applied, the Draft EIS reported that construction and operation of the KGGP are expected to result in the following outcomes in relation to vegetation:

- No removal of known recordings of any listed threatened flora species.
- Minimal disturbance to conservation significant flora species.

After mitigation is applied, the Draft EIS reported that construction and operation of the KGGP are expected to result in the following outcomes in relation to terrestrial fauna and their associated habitats:

- Clearing of approximately 2,200 ha of potential fauna habitat, with approximately 60% of this to be rehabilitated or re-established through natural re-colonisation and regrowth.
- The introduction or spread of weeds or feral animals into the pipeline ROW would be minimised.
- Fauna mortality from vehicle strike or capture in trench would be minimal.
- Degradation to fauna habitat from fire ignition, dust, waste disposal or extraction of groundwater or surface water would be minimal.
- No impact to significant fauna habitat areas/nests through avoidance and re-location of ancillary infrastructure.

The survey results for the area to the north of the Mitchell Ranges (KP399-435) do not alter these predictions. One threatened fauna species (Merten's Water Monitor) was recorded during survey. The predicted environmental outcomes for this species are addressed in section 5.11.

5.15 PRELIMINARY ASSESSMENT OF ENVIRONMENTAL VALUES AND CONSTRAINTS OF MITCHELL RANGES ALTERNATIVE ALIGNMENT (KP393-466.5)

5.15.1 Introduction

At the request of Aboriginal traditional owners, an alternative alignment for the pipeline corridor is under consideration. While subject to further design, the indicative alignment is shown in Figures 5-20 and 5-21**.** The proposed alternative alignment would divert from the alignment proposed in the Draft EIS (the current alignment) at approximately KP393, passing eastward to the south of Donydji and then following a north easterly route across a low section of the Mitchell Ranges and reconnecting with the current alignment at approximately KP466.5. At its furthest, the alternative alignment would be approximately 15 km from the current alignment. For the section of the alternative alignment commencing east of Donydji to the Maidjunga River (approximately half of the alignment), the route selected is in close proximity to an old mining access track that has partially revegetated following earlier disturbance.

The length of the alternative alignment would be approximately 70 km, subject to refinement during ongoing consultation with Aboriginal traditional owners and detailed design. In comparison, the current alignment (proposed in the Draft EIS) for this section would be approximately 74 km. The alternative alignment when finalised is therefore unlikely to be longer or result in greater vegetation clearing than the currently proposed alignment.

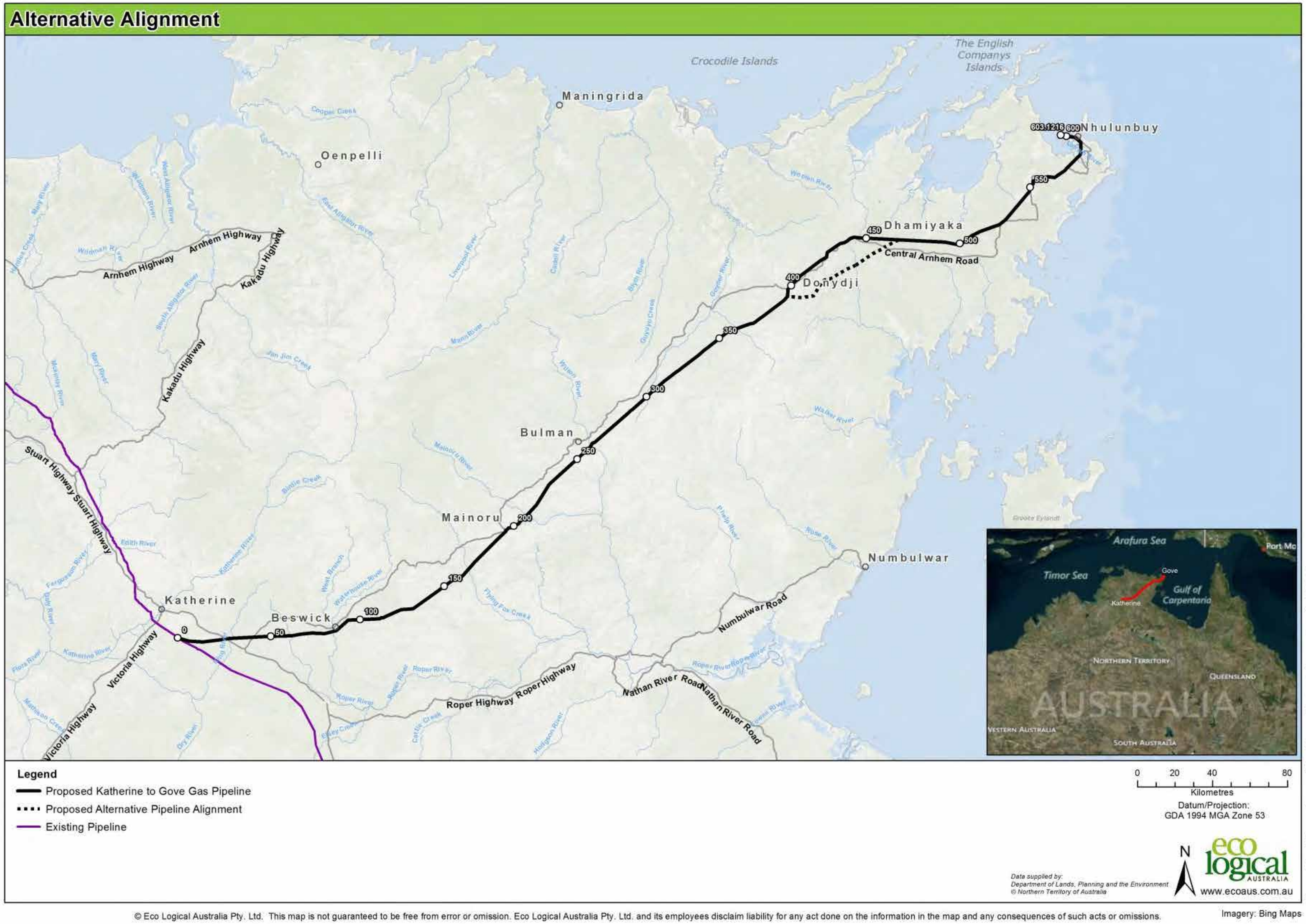


Figure 5-20: Mitchell Ranges alternative alignment within the proposed Katherine to Gove Gas Pipeline alignment

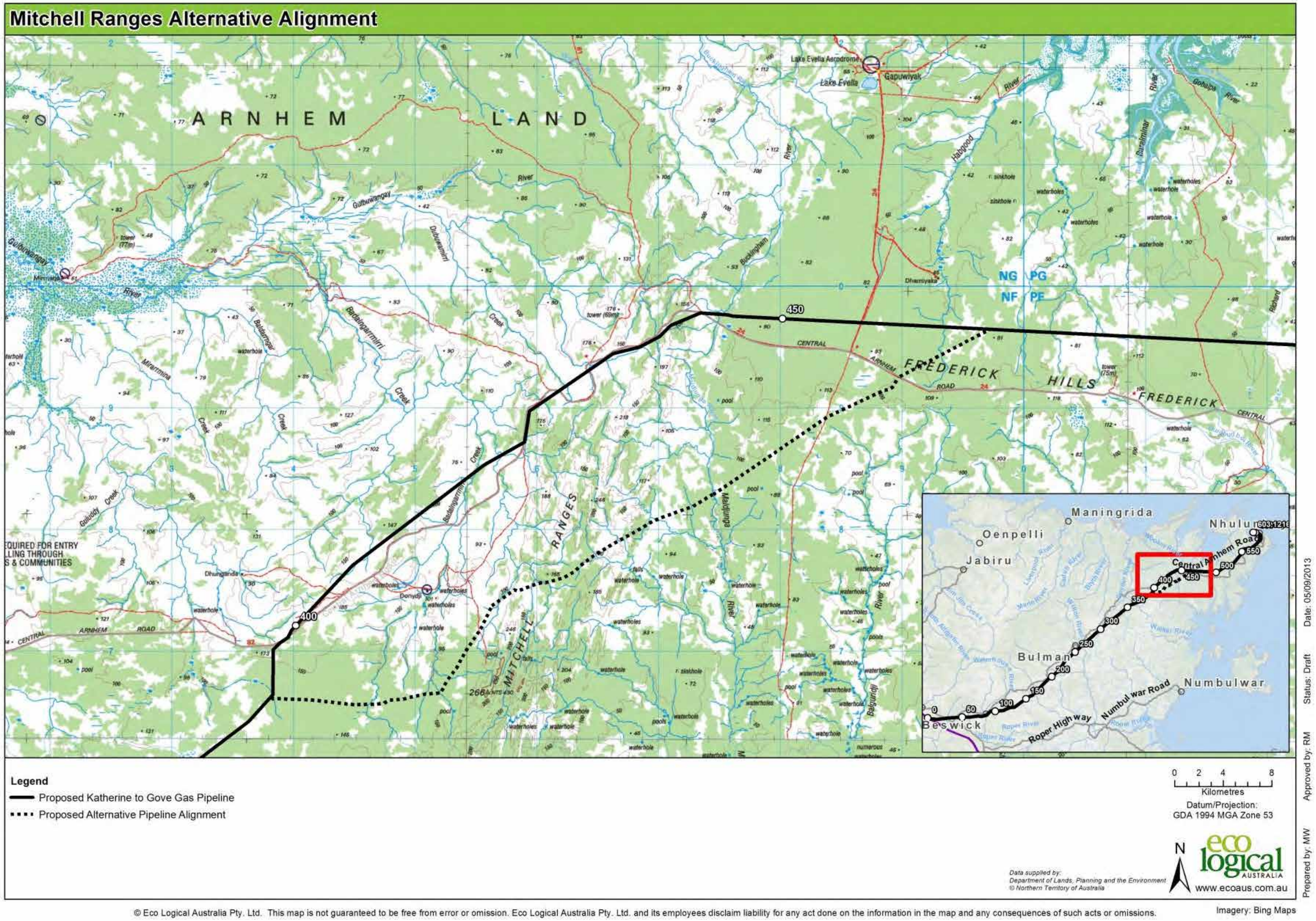


Figure 5-21: Mitchell Ranges alternative alignment detail

5.15.2 Assessment approach

Desktop review of available regional information, new vegetation mapping and a preliminary habitat values survey of the area traversed by this alignment was undertaken with the objective of establishing the habitat values and environmental constraints important to a number of species of concern (Matters of NES) identified in Chapter 10 of the Draft EIS and this EIS Supplement.

Vegetation mapping of the region to be traversed by the proposed alternative alignment was prepared using the methodologies described in section 4.1 of this EIS Supplement.

The preliminary habitat values survey was conducted under NLC permit by two qualified ecologists from Eco Logical Australia Pty over the period 19-23 August 2013. The ecologists were accompanied by staff of the NLC, Aboriginal traditional owners and representatives of Pacific Aluminium.

The habitat values survey comprised an aerial (helicopter) fly over of the proposed alternative alignment and ground reconnaissance by vehicle and foot over a period of three days (Figure 5-22). Observations were made and recorded of key potential habitat elements (Table 5-30) likely to have higher value for species comprising Matters of NES, based on targeted survey for the nearby alignment to the north of the Mitchell Ranges (see section 4.4 of this EIS Supplement).

Waypoints for observed habitats were recorded in the field using a handheld GPS for subsequent mapping. Where possible, photos were taken at the corresponding waypoints.

Table 5-30: Target potential habitat for the preliminary survey of Mitchell Ranges alternative alignment and relevant to Matters of NES

POTENTIAL HABITAT ELEMENT	RELEVANCE TO MATTERS OF NES OR OTHER THREATENED SPECIES
Heath vegetation.	Potentially indicative of the EPBC listed Arnhem Plateau Sandstone Shrubland Threatened Ecological Community (TEC).
Patches of Salmon Gums.	Gouldian Finch breeding habitat (when located within 4 km of perennial water).
Patches of monsoon vine forest.	Northern Masked Owl, Red Goshawk.
Significant areas of riparian vegetation.	Northern Masked Owl, Red Goshawk.
Areas of tall forest in proximity to watercourses.	Northern Masked Owl, Red Goshawk.
Rocky areas in proximity to tall woodland.	Northern Quoll (denning).
Watercourses or remnant pools upstream from large estuaries or with connections to broad floodplains.	Freshwater Sawfish.
Wetland habitat.	Australian Painted Snipe and Australasian Bittern.

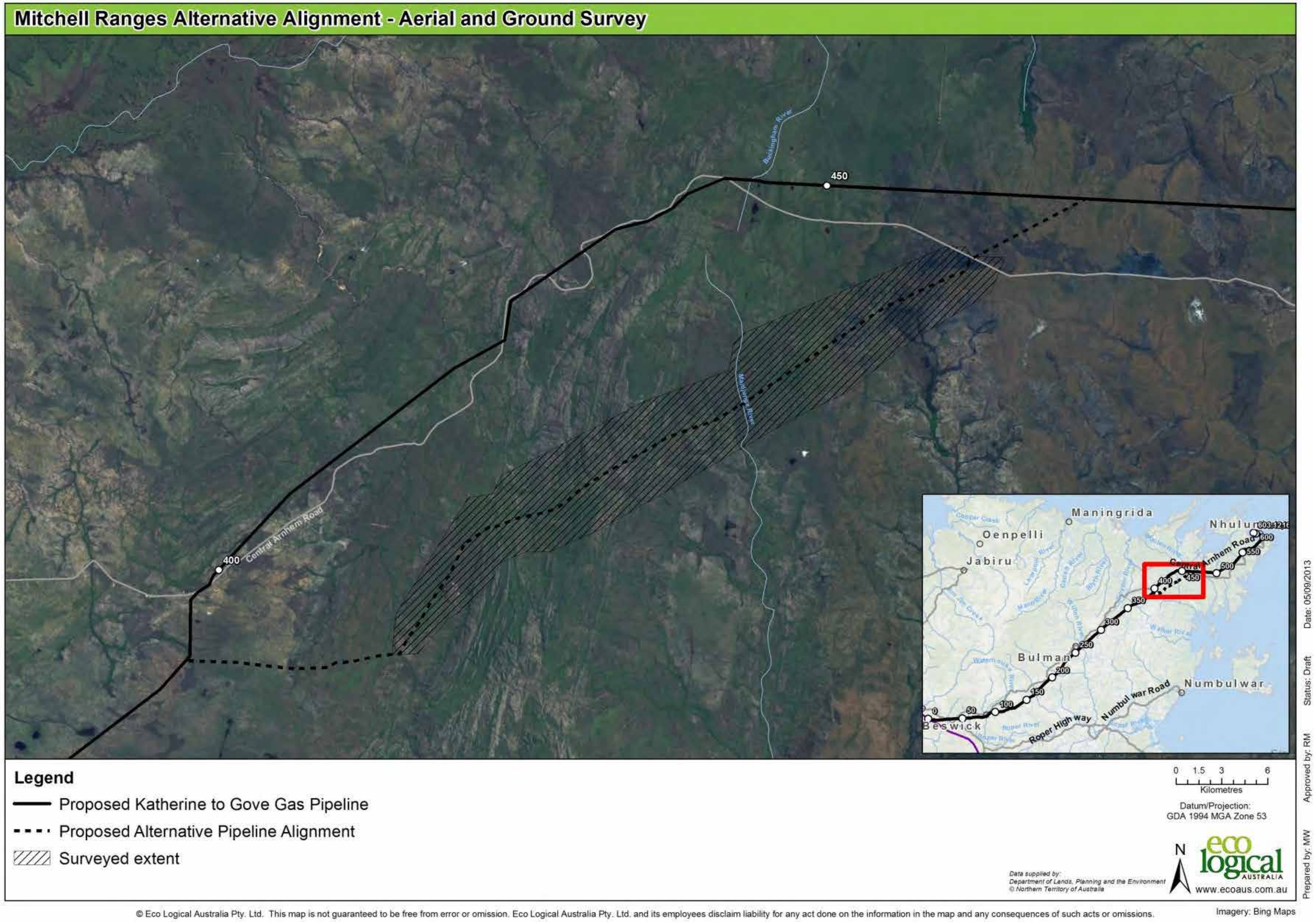


Figure 5-22: Location of habitat values survey for the Mitchell Ranges alternative alignment

5.15.3 Description of alternative alignment environs

Topography, land systems and soils

Topography in the region traversed by the alternative alignment is shown at Figure 5-23. Land systems are areas of country through which there is a recurring pattern of topography, vegetation and soils. The Mitchell Ranges alternative alignment passes through no new land systems or soil types to those traversed by the originally proposed alignment (Figure 5-25).

The alternative alignment passes primarily through extensive deeply weathered lateritic plains and rises, intersected by steep rocky plateaux and hills and two areas of alluvial floodplains associated with the Maidjunga River. The proportion of alluvial floodplains traversed by newly proposed alignment is roughly half of that of the original, while a similar proportion of rocky plateaux is traversed.

The more southerly alternative alignment passes from west to east through soil units classified as:

AC13 Yellow earthy sands, often deep but including shallow areas with laterite boulders and gravels. These soils are associated with gently sloping plains with some low to steep laterite ridges.

JJ29 Shallow, gritty soils and sandy loams on mostly low, rounded granitic hills

BA8 Shallow sands and sandy loams on ranges and/or prominent ridges with narrow valleys and common rock outcrops; formed on sandstones, siltstones and shales.

AC14 Yellow earthy sands on gently sloping plains with areas of laterite, broken by hills, ridges, and mesas, mainly on sandstones, siltstones or granites.

MY2 Ironstone gravels in a red earth matrix, together with red and yellow earths on gently sloping to flat plateaux or plains characterised by laterites and laterite boulders and gravels and narrow stream valleys.

(Data source: CSIRO, Department of Lands, Planning and the Environment)

The alternative alignment passes through significantly greater areas of AC13, AC14 and JJ29 soils, a similar extent of the BA8 soils associated with ridges and ranges, approximately half of the MY2 soils, and none of the JJ28 soils (stony shallow sands) crossed in the original alignment (Figure 5-24).

The largest watercourses proposed to be crossed by the alternative alignment would be the Maidjunga River and the Habgood River, neither of which have perennial flow. A number of smaller ephemeral creeks with isolated pools running off the Mitchell Ranges would also be crossed (Figure 5-21).

Vegetation and habitats

The results of vegetation mapping are provided in section 5.1.3. The dominant vegetation communities affected by clearing for the alternative ROW would be *Eucalyptus* open forest and *Eucalyptus* woodland, each comprising 26% of the ROW. The vegetation analysis of the alternative ROW alignment and the habitat values survey confirm that no vine forest or vine thicket vegetation communities would be cleared to establish the ROW for the Mitchell Ranges alternative alignment.

Stands of riparian vegetation and tall forest in proximity to watercourses are limited in extent along the surveyed alignment. These are of particular relevance to habitat requirements for the Northern Masked Owl and Red Goshawk. The rocky landscape of the Mitchell Ranges and close proximity to perennial waterholes associated with watercourses makes it a favourable landscape for Northern Quolls. It is possible that the rugged nature of the ranges is less favourable to cane toads that have caused a significant reduction of Northern Quoll populations across the savanna landscape.

Other important habitat features relevant to Matters of NES recorded during the preliminary habitat values survey are presented in Figures 5-26 to 5-28. The most significant of these were small patches of Salmon Gums *Eucalyptus tintinnans* (within 4 km of perennial water) (Figure-5-28), providing potential breeding habitat for the Gouldian Finch. The patches were small (1-5 ha) and the trees sparsely distributed. Two small areas of possible heath vegetation with floristic elements consistent with the EPBC listed Arnhem Plateau Sandstone Shrubland Threatened Ecological Community were recorded during ground survey (Figure 5-26). However, the patch size of the largest was no greater than 1 ha and would therefore not meet the condition thresholds for protection under the EPBC Act (requiring a patch size > 5 ha; Commonwealth Listing Advice: Threatened Species Scientific Committee 2011). These patches were located away from the proposed alignment and would not be cleared. Patches of tall forest near water and riparian vegetation were recorded at a number of locations (Figure 5-27).

No wetland habitat or monsoon vine forest was recorded in either vegetation mapping or survey (aerial or ground) in the vicinity of the proposed realignment.

The Maidjunga River was not flowing at the time of the preliminary habitat values survey and would be dry at the location of likely crossing by the proposed realignment. Small isolated perennial pools within the watercourse were identified in the broader area surrounding the proposed crossing however, these were assessed by an experienced aquatic ecologist as lacking the requisite connection to tidal or floodplain habitat to be suitable for the Freshwater Sawfish. Aboriginal traditional owners also verified that the sawfish is not known in the vicinity of the proposed realignment.

Very few weed species were recorded. One occurrence of Spinyhead Sida (*Sida acuta)* was recorded outside of the survey area in riparian vegetation associated with a tributary of the Maidjunga River approximately four kilometres from the proposed realignment. Spinyhead Sida is a declared weed, scheduled as B/C (growth and spread to be controlled/ not to be introduced to the Territory) under the *Weeds Management Act*. Otherwise the region traversed by the proposed realignment is largely weed free.

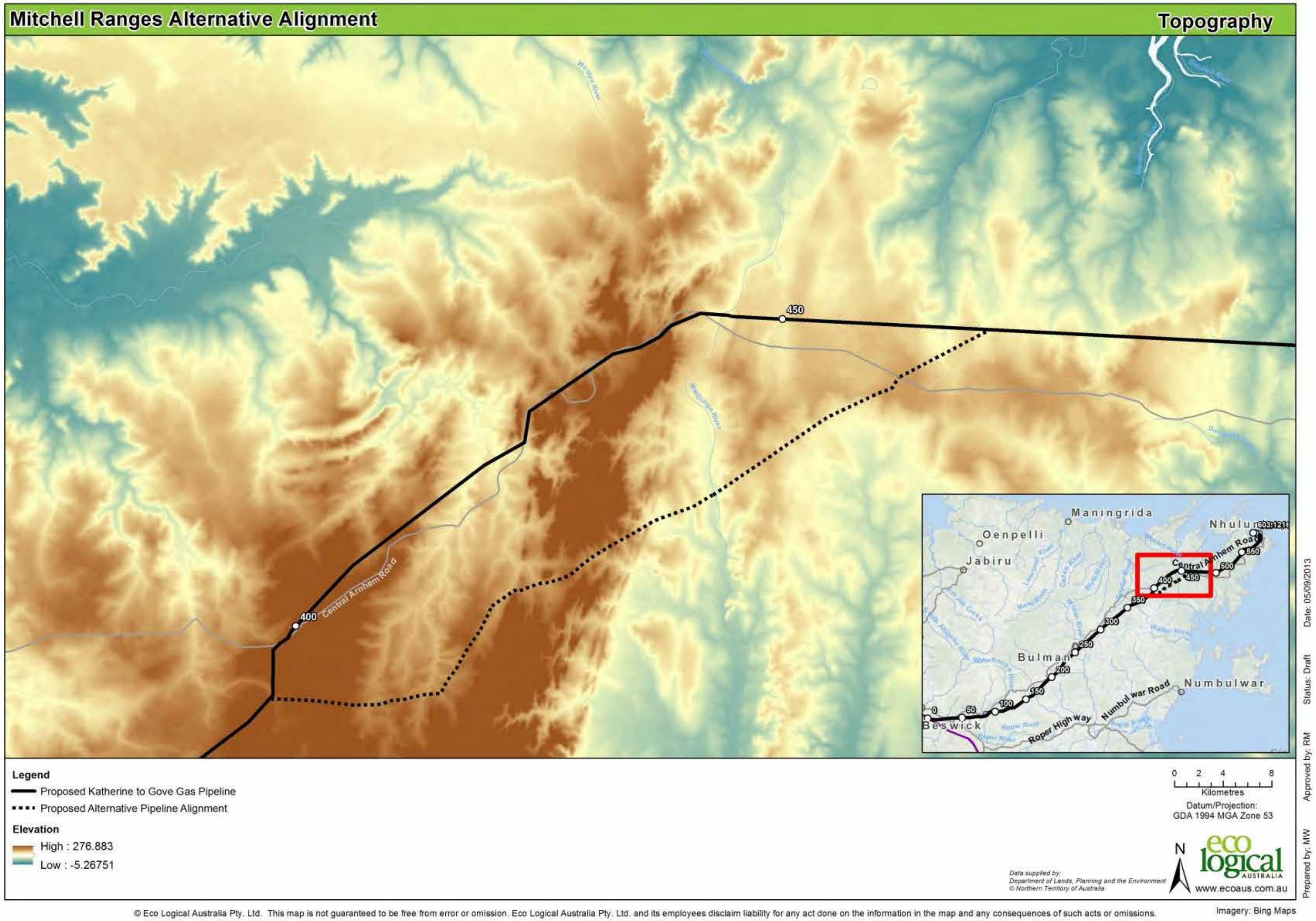


Figure 5-23: Mitchell Ranges alternative alignment and regional topography

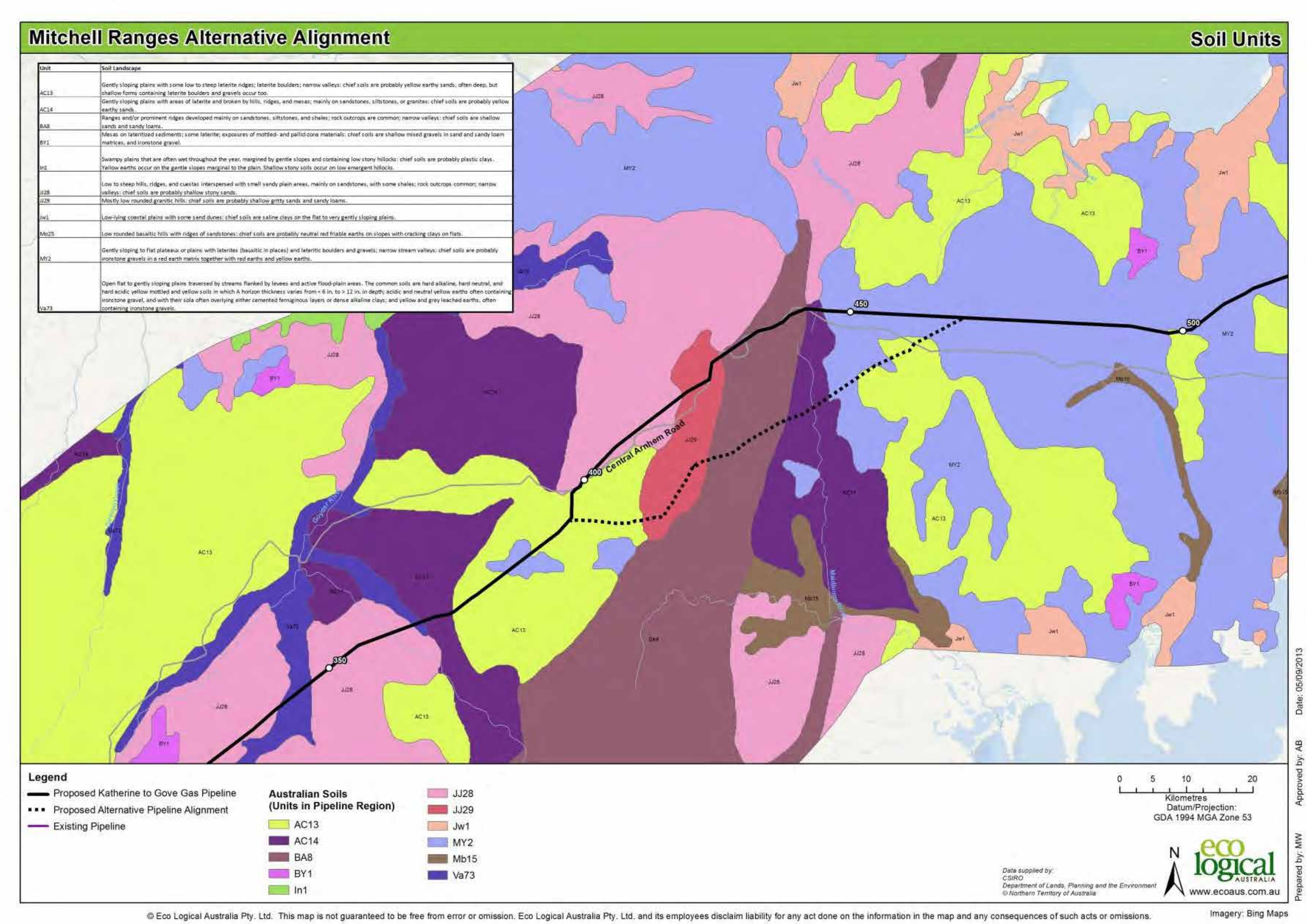


Figure 5-24: Mitchel Ranges alternative alignment and regional soils distribution

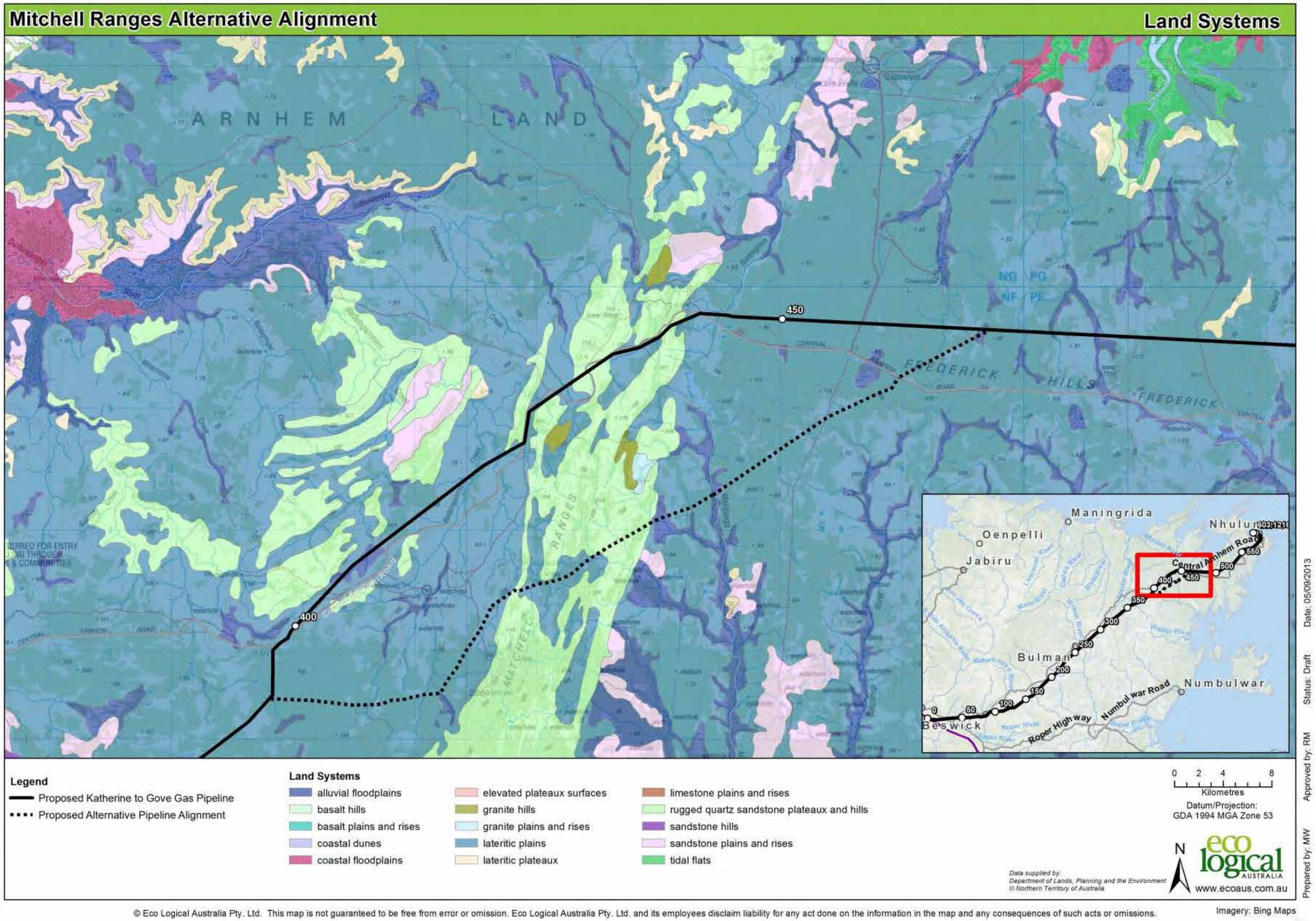


Figure 5-25: Mitchell Ranges and regional Land Systems

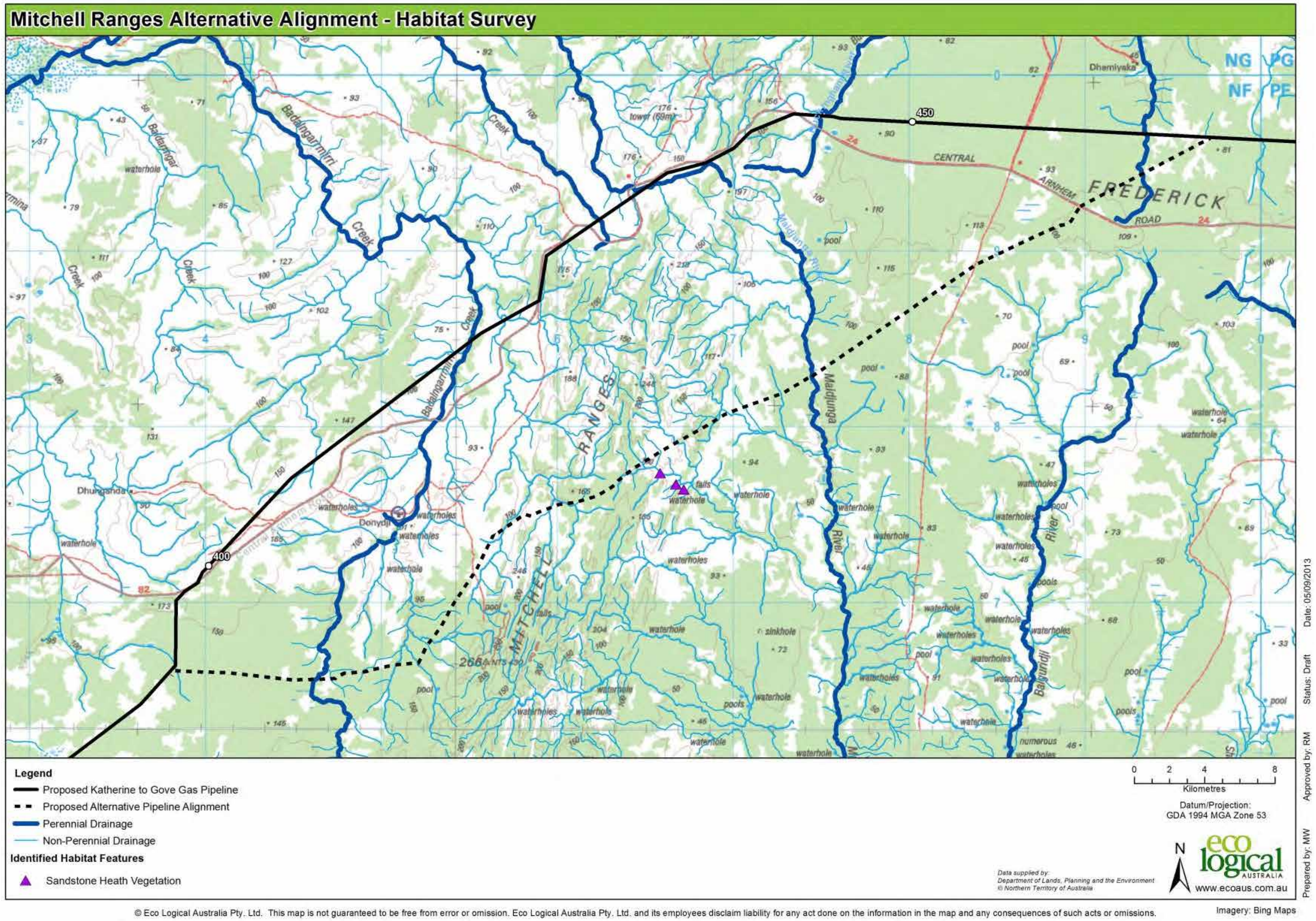


Figure 5-26: Heath vegetation recorded during preliminary habitat values survey of Mitchell Ranges alternative alignment

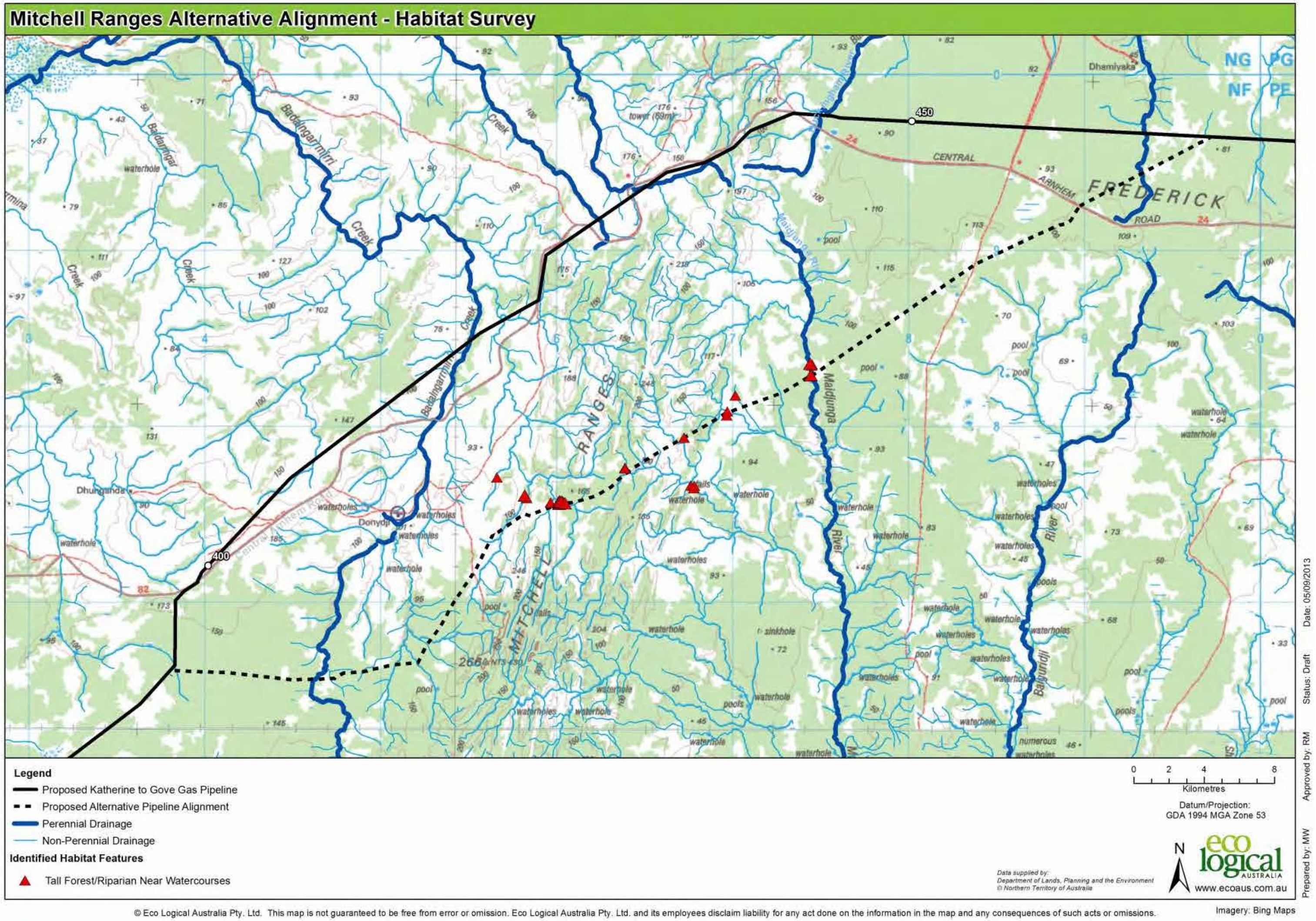


Figure 5-27: Tall forest / riparian vegetation near watercourses recorded during preliminary habitat values survey of Mitchell Ranges alternative alignment

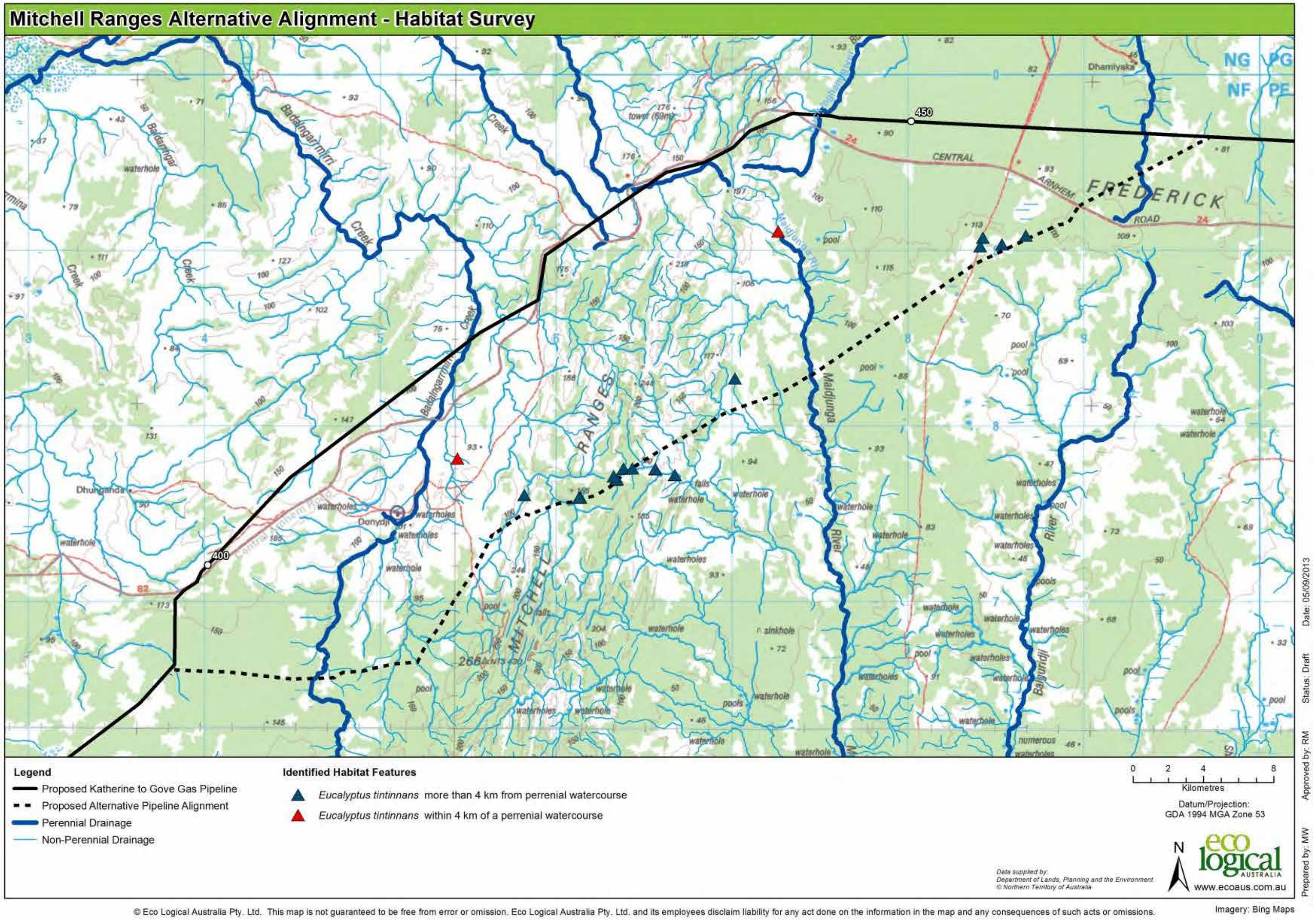


Figure 5-28: Salmon gums recorded during preliminary habitat values survey of Mitchell Ranges alternative alignment

5.15.4 Comparative environmental assessment

Approximately 208 ha of native vegetation would be cleared through construction of the alternative ROW. The distance traversed by the alternative alignment is shorter (by approximately 4 km) than the substituted section of the current alignment. Subject to determination of the finalised alignment, this could result in a small reduction in native vegetation clearing of approximately 12 ha, should the realignment option be implemented. Vegetation mapping analysis indicates that the vegetation communities between the two alignments are broadly consistent with no large areas of different vegetation communities occurring in the vicinity of the alternative alignment, compared to the substituted section of the current alignment. The dominant vegetation community along the proposed realignment is *Eucalyptus* open forest and *Eucalyptus* woodland, each comprising 26% of the ROW. Clearing to establish the proposed realignment would affect less than 4% of all vegetation communities (by area), when compared to their distribution in the region one kilometre either side of the pipeline centreline. For those fauna species with broad habitat requirements across the savanna woodlands commonly found along the alignment, the impact of the alternative alignment is unlikely to be greater than predicted for the alignment proposed in the Draft EIS.

While there is potential for the Arnhem Plateau Sandstone Shrubland Threatened Ecological Community to occur in the region of the Mitchell Ranges, the preliminary habitat values survey indicates that patches of heath vegetation in proximity to the realignment are small, unlikely to meet condition thresholds for EPBC protection and (with small patch size) would be easily avoided during final survey for the proposed alignment. Disturbance of the Arnhem Plateau Sandstone Shrubland Threatened Ecological Community is therefore very unlikely.

GIS analysis of the vegetation communities favourable to a number of threatened species of concern was conducted and the methodologies and results were described in sections 5.5 to 5.9 of this EIS Supplement. The results of these analyses indicate that construction of the alternative Mitchell Ranges alignment would be unlikely to alter the impact predicted in the EIS for the following species:

- Gouldian Finch.
- Red Goshawk.
- Northern Masked Owl.
- Northern Crested Shrike-tit.
- Northern Quoll.

Patches of potential breeding habitat for the Gouldian Finch occur in the vicinity of the realignment however the patch size is small and trees are sparsely scattered. Therefore removal of potential breeding habitat trees would be avoided during final survey for the proposed pipeline alignment. Loss of breeding habitat for the Gouldian Finch resulting from construction of the ROW within the alternative alignment is therefore unlikely.

Potential nesting trees and foraging areas for the Red Goshawk and Northern Masked Owl occur across the broader region, and the alternative Mitchell Ranges alignment is no different in this regard. Individual large trees in riparian areas would be avoided or removal minimised during construction. Construction in highly rocky areas which may provide potential higher value denning habitat for the Northern Quoll would be avoided through final route selection.

The Maidjunga River is unlikely to hold suitable habitat for the Freshwater Sawfish and the point of crossing would be expected to be dry under usual dry season conditions of construction. Loss of Freshwater Sawfish habitat arising from construction of the ROW within the alternative alignment is therefore very unlikely.

As no wetlands or extensive floodplains were recorded in the vicinity of the realignment, there will be no loss or disturbance to habitat important for the Australian Painted Snipe or Australasian Bittern.

In summary, the residual environmental impact for species of concern comprising Matters of NES have been assessed as unlikely to be significantly different for the alternative Mitchell Ranges alignment compared to the alignment proposed in the Draft EIS. .

Should a decision be made to implement the alternative Mitchell Ranges alignment, Pacific Aluminium commits (consistent with section 3.4 of this EIS Supplement) to:

- Conducting further flora and fauna survey (including habitat mapping for Gouldian Finch, Red Goshawk and other relevant species comprising Matters of NES) prior to commencing construction in the area affected by the realignment option, for the purposes of informing final alignment and construction environment management.
- Submitting a report accompanying the Final Alignment Plan(s) to DSEWPaC and the NT EPA that demonstrate how impacts on the following have been avoided in the selection of the final alignment:
  - Vegetation representative of the Arnhem Plateau Sandstone Shrubland Threatened Ecological Community (TEC).
  - Known, likely or potential critical, regionally significant and/or locally restricted habitat for threatened and/or migratory species listed under TPWC Act or EPBC Act.
- In the event that any of the above matters are not able to be avoided through adjustments to the alignment or working width of the ROW, Pacific Aluminium would evaluate whether the impacts are significant or not. Should residual impacts be significant, an environmental offset sufficient to mitigate the residual impact would be proposed. This would be detailed in the report accompanying the Final Alignment Plan including a description of measures to minimise and manage impacts on these species during and following construction.

Table 5-31 summarises the likely outcome for Matters of NES if the alternative alignment was constructed in preference to the alignment presented in the Draft EIS.

Table 5-31: Summary of comparison of Matters of NES for the alternative Mitchell Ranges alignment

HABITAT ELEMENT	RELEVANCE TO MATTERS OF NES	PRELIMINARY ASSESSMENT OF ALTERNATIVE ALIGNMENT	POTENTIAL IMPACT ON MATTERS OF NES
Heath vegetation	Potentially indicative of the EPBC listed Arnhem Plateau Sandstone Shrubland Threatened Ecological Community	Two small patches of heath vegetation were recorded during ground reconnaissance in the vicinity of the realignment but not within the pipeline corridor. The largest of these was approximately 1 ha and therefore would not meet the conditional thresholds (patch size > 5 ha) for protection of the threatened ecological community	The extent of patches of heath vegetation will be confirmed during detailed vegetation mapping and further flora survey of the alignment. On the strength of low likelihood of patches meeting condition thresholds (as indicated by ground reconnaissance) and capacity for any unrecorded patches to be avoided during detailed survey, it is considered feasible to ensure no change to impacts of the currently proposed

HABITAT ELEMENT	RELEVANCE TO MATTERS OF NES	PRELIMINARY ASSESSMENT OF ALTERNATIVE ALIGNMENT	POTENTIAL IMPACT ON MATTERS OF NES
			alignment.
Patches of Salmon Gums	Gouldian Finch breeding habitat (when located within 4 km of perennial water)	Isolated patches (1-5 ha) of Salmon Gums recorded in proximity (< 4 km) of perennial water, in the vicinity of the proposed realignment. On the ground reconnaissance recorded sparsely scattered trees rather than dense stands.	The isolated patches of scattered Salmon Gums would be avoided during detailed survey. With breeding trees avoided: no change to the impacts of the currently proposed alignment.
Patches of monsoon vine forest	Northern Masked Owl, Red Goshawk	No patches of monsoon vine forest were recorded during ground or aerial reconnaissance in the vicinity of the proposed realignment.	No change to the impacts of the currently proposed alignment.
Significant areas of riparian vegetation	Northern Masked Owl, Red Goshawk	This habitat was present but not widespread across the region traversed by the realignment.	Individual large trees that are potentially nesting habitat would be avoided during the detailed design stage. GIS vegetation analysis indicates impacts unlikely to be different.
Areas of tall forest in proximity to watercourses	Northern Masked Owl, Red Goshawk	This habitat was present but not widespread across the region traversed by the realignment.	Individual large trees that are potentially nesting habitat would be avoided during the detailed design stage.
Rocky areas in proximity to tall woodland	Northern Quoll (denning)	Rocky areas potentially providing favourable denning and foraging habitat present.	Very rocky areas are not favourable to pipe construction and would be avoided during detailed design. GIS vegetation analysis indicates impacts unlikely to be different.
Watercourses or remnant pools upstream from large estuaries or with connections to broad floodplains	Freshwater Sawfish	No watercourses recorded with the requisite flow and connection to tidal or floodplain habitat. Small perennial pools recorded at Maidjunga River assessed by an experienced aquatic ecologist as unlikely to provide suitable habitat for Freshwater Sawfish. This was confirmed by local knowledge from Aboriginal traditional owners.	No change to the impacts of the currently proposed alignment.
Wetland habitat	Australian Painted Snipe and Australasian Bittern	No appropriate habitat was recorded in the vicinity of the proposed realignment	No change to the impacts of the currently proposed alignment.


PACIFIC ALUMINIUM

Chapter 6

Comment on Draft EIS: issues and responses

PACIFIC ALUMINIUM

Contents

6 Comment on Draft EIS: issues and responses

6.1 CONSULTATION SUMMARY

Eleven submissions were received on the Draft EIS, comprising seven government agencies and four non-government organisations. Table 6-1 shows the frequency of issues raised across the 11 submissions. The most frequently raised issues in submissions were:

- Further clarification of project description.
- Construction of watercourse crossings.
- Health and safety.
- Management of weeds and feral animals.
- Impacts on Freshwater Sawfish.
- Impacts on Gouldian Finch.
- Other conservation significant flora/fauna species (including those not considered) and management.
- Impacts of noise on fauna and/or local communities.
- Local employment.
- Detail in management plans.

These issues and others are discussed in the section below and in the detailed Comment – Response table at Appendix A.

List of submitters

1. Department of Defence (DoD)
2. Amateur Fishermen's Association of the NT (AFANT)
3. NT Department of Business (DoB)
4. NT Department of Health (DoH)
5. NT Department of Transport (DoT)
6. Environment Centre NT (ECNT)
7. Northern Land Council (NLC)
8. Department of Primary Industry and Fisheries NT (DPIF)
9. Dhimurru Aboriginal Corporation (DAC)
10. NT Department of Land Resource Management (DLRM)
11. NT Environment Protection Authority/(Australian) Department of Sustainability, Environment, Water, Population and Communities (NT EPA / DSEWPaC)

Table 6-1: Matrix of frequency of issues raised in all submissions

ISSUE	SUBMISSION											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
Further clarification of project description		✓			✓	✓	✓	✓	✓	✓	✓	8
Construction of watercourse crossings		✓				✓	✓	✓			✓	5
Health and safety	✓			✓	✓		✓		✓			5
Management of weeds and feral animals						✓	✓		✓	✓		4
Impacts on Freshwater Sawfish		✓				✓	✓				✓	4
Impacts on Gouldian Finch						✓	✓			✓	✓	4
Other conservation significant flora/fauna species (including						✓	✓			✓	✓	4

ISSUE	SUBMISSION											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
those not considered) and management												
Impacts of noise on fauna and/or local communities					✓	✓	✓				✓	4
Local employment			✓				✓		✓		✓	4
Lack of detail in Management Plans					✓	✓	✓			✓		4
Impacts of water extraction on water resources		✓					✓				✓	3
Erosion, sedimentation and other impacts on soils		✓					✓				✓	3
Paucity of baseline data. Additional survey work recommended						✓	✓				✓	3
Location and design of access tracks		✓					✓		✓			3
Management of access post-construction							✓		✓		✓	3
Rehabilitation methods and management							✓		✓		✓	3
Offsets						✓	✓				✓	3
Impacts on fauna from trenching							✓			✓	✓	3
Safety risks to aircraft and limitations of existing aerodromes	✓				✓							2
Contamination of surface water and/or groundwater							✓				✓	2
More detailed analysis of alternative energy sources (LNG, renewable etc.)			✓			✓						2

ISSUE	SUBMISSION											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
Economic benefits/impacts			✓				✓					2
Impacts on existing Infrastructure and transport/traffic					✓				✓			2
Greenhouse gas (GHG) emissions						✓	✓					2
Indigenous values and heritage, consultation with Traditional Owners and IPAs							✓		✓			2
Impacts on karst formations							✓				✓	2
Acid sulphate soils							✓				✓	2
Fire management							✓		✓			2
Social impacts							✓				✓	2
Cumulative impacts					✓		✓					2
Survey methodology							✓				✓	2
Impacts on riparian vegetation											✓	1
Seismicity and earthquakes							✓					1
Impacts on exploration tenements							✓					1
Air quality impacts - dust							✓					1

6.2 KEY ISSUES RAISED IN CONSULTATION

6.2.1 Project roles, responsibilities and implementation

A number of respondents to the Draft EIS queried the roles and responsibilities of Pacific Aluminium as the proponent of the KGGP Project and those of the contractor, particularly regarding implementation of the EMP and the current stage of project planning.

Chapter 17 of the Draft EIS documents the overall management arrangements for the project and acknowledges that:

> The EMP has been developed during the feasibility stage of the development of the KGGP project. Accordingly the management sub-plans are conceptual and have been termed 'provisional' in acknowledgement that as the project enters the design and implementation phases, there will be more specificity around aspects of project construction and operation and the management plans will likewise become more detailed. The EMP would also continue to be developed and refined following the conclusion of the assessment process, taking into consideration the proposed timing of development activities, comments on the Draft EIS and incorporating the recommendations and conclusions of the Environmental Assessment Report.

The above is consistent with the NT EPA *Guidelines for the preparation of the EIS* which indicates that the EMP (and its sub-plans) should be strategic, "describing a *framework* for environmental management of the project, with as much detail as is practicable."

The Draft EIS (Chapter 17) also noted that a key consideration for the environmental management of the KGGP Project will be that systems are in place to ensure that the measures in the provisional management plans are accounted for in the preparation of the detailed plans that would be subject to authorisation. Systems would ensure there is sound reasoning if changes are made on the ground, and that during construction, the commitments of the management plans are being adhered to.

This will be achieved through project controls implemented by both Pacific Aluminium and the construction contractors including:

- Independent review of detailed management plans for their conformity with EIS commitments.
- Contractor environmental controls.
- Inspection and third party auditing of project construction activities (regular inspections and two formal compliance audits).
- Third party compliance auditing of project operation (annual).
- Development of a Land Access Protocol and provision of cultural awareness training for all employees working on the KGGP Project.

Further details on key management measures are provided in this EIS Supplement) , and additional detail on roles and responsibilities is provided below.

The KGGP Project would be executed by an integrated project team of Pacific Aluminium (Owner) and their nominated contractors:

- Design Consultant (WorleyParsons).

- Pipeline Contractor (Spiecapag Lucas Joint Venture).
- Compressor Station Contractor (entity to be determined).
- Operator (to be determined).

Pacific Aluminium is the proponent of the KGGP Project with overall responsibility for regulatory compliance and ensuring that design, construction and operation of the project meet the requirements of the Pipeline Management Plan, Consent to Construct and Operate, and all other regulatory requirements, including environmental commitments.

Pacific Aluminium has a certified HSEQ management system that meets the requirements of both ISO 14001 and AS 4801, for the purpose of ensuring that all works being undertaken as a part of their operations meet Health, Safety and Environmental requirements.

The HSEQ management system provides the framework for Pacific Aluminium to manage works being undertaken by their contractors, including those on the KGGP project, for the purpose of ensuring that their HSEQ requirements are met. The HSEQ management system is comprised of 17 key elements. Although all these elements are vital to ensuring that a project is well executed, the project team will focus on the following key elements during construction for the purpose of ensuring compliance with commitments laid out in the EIS and regulatory approvals:

- Element 2 – Legal and Other Requirements.
- Element 3 – Hazard Identification and Risk Management.
- Element 7 – Supplier and Contractor Management.
- Element 14 – Non-conformance, and incident and action management.
- Element 16 – Performance assessment and auditing.

As a component of this system, Pacific Aluminium requires each KGGP contractor to have a suitable HSEQ management system in place prior to commencing works. Pacific Aluminium would be responsible for ensuring the relevant contractor develops a fit-for-purpose Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) outlining the key HSEQ commitments and management measures, applying the 'Plan, Do, Check and Adjust/Act' execution methodology. Third party auditing to review and confirm compliance will be commissioned by Pacific Aluminium.

The construction contractor is responsible for development of the CEMP. Pacific Aluminium will be responsible for ensuring the CEMP is fit-for-use and is implemented appropriately, through auditing systems, to review and confirm that the environmental commitments and desired outcomes are achieved.

The purpose of the CEMP is to ensure that appropriate environmental protection and impact minimisation techniques are implemented during and following construction. This CEMP establishes performance standards that the KGGP Project is to achieve in its implementation, for use by a wide range of Project personnel.

The CEMP avoids being too prescriptive regarding how performance is to be achieved; rather it details the available management strategies that will be applied to achieve the performance standards set by the Project.

The CEMP will be used by:

- Managers to assist in the planning and resourcing of functions and to allow for assessment of required skills, competencies and training.
- Construction Superintendents to assist in the selection of workforce and equipment and to identify specific training, competencies and resources for the Project.
- Construction Supervisors (foremen) to allow them to clearly understand specific requirements for specific tasks at specific locations.
- Auditors to easily understand the general performance requirements of the Project and to enable each of these requirements to be checked and reviewed in an orderly manner.

The CEMP will be used for preparation of Quality Assurance Documentation and Daily/Weekly Reporting by enabling the development of recording documentation for daily activities, location-based activities and specific activities by all construction crews that demonstrate compliance with the CEMP.

6.2.2 Landforms and soils

Reinstatement of disturbed areas, erosion control, avoidance of significant landforms and management of fragile soil types were important matters addressed in the Draft EIS. Respondents to the Draft EIS requested additional detail on measures to manage potential impacts on karst features, sensitive soil types and disturbance of acid sulphate soils. Risks to the pipeline (and consequent impacts) from seismic activity was also raised.

Karst features

Initial studies have identified karst landscape associated with the Tindall Limestone Formation occurring within the initial 60 km of the KGGP route. Sinkholes formed by weathering/dissolution of soluble carbonate rocks have been identified within close proximity of the initial 60km and between KP441 and KP560 of the pipeline corridor.

Karp (2002) assessed land degradation associated with sinkhole development in the Katherine region. The study focused on the Tindall Limestone (within the Daly Basin) underlying the township of Katherine. It should be noted that sinkholes may occur beyond the bounds of the area investigated. A total of 283 sinkholes were identified within the study area. The distribution of sink holes identified by Karp (2002) in relation to the pipeline corridor is shown in Figures 6-1, 6-2 and 6-3. Seven sinkholes (between approximately KP3.5 and KP8) are within 500 m of the proposed KGGP ROW centreline.

During the investigation work for the Trans Territory Pipeline (TTP), Golder Associates identified a collapsed sinkhole approximately 300 m to 500 m east of Boggy Creek (KP511.6 approx.). Golder Associates stated that geological mapping in the area does not indicate the presence of limestone. Review of the current geological information shows that in the area from KP486.4 to KP560, the solid geology includes Cretaceous to Jurassic age sedimentary deposits comprising sandstone, mudstone and limestone. These rocks are extensively masked by a Regolith unit characterised by alluvial, colluvial, residual and other undifferentiated unconsolidated deposits in this area.

Detailed mapping and geophysical and geotechnical investigation studies of the potential karst formations within the project area have been scoped and are planned for 2013, subject to land access approval. The studies will determine the extent of karst prone to sinkhole development within the pipeline corridor and facility compounds. Initial assessments have identified the area in the vicinity of KP0-60 and between KP441-560 for further targeted investigation.

Detection of sinkholes within the areas of concern is envisaged to include the following phased approach:

- Desktop studies, using topographic maps and high resolution aerial photographs to identify existing sinkholes within and/or near to the pipeline corridor and facility locations, and to establish the extent of the potential karst formations.
- Non-intrusive testing, such as ground penetrating radar and/or seismic refraction survey to investigate the pipeline corridor and facility locations, within the areas of concern.
- Intrusive testing, such as boreholes and test pitting to calibrate and confirm findings of non-intrusive testing.

A subsequent comprehensive hazard study will be undertaken to underpin measures to mitigate the risk of sinkholes that may impact the pipeline and associated facilities.

Karp (2002) observed that sinkhole formation was linked to seasonal changes in the groundwater table and surface drainage. The study also assessed the relationship between sinkhole distribution, geology, depth to bedrock, topography and morphology. Results of the analysis showed there was no relationship between the above criteria, and that the mapped sinkholes locations were randomly distributed features.

For this reason, the planned assessment will encompass the entire section of the proposed pipeline route which lies within the identified geological units potentially susceptible to karst feature formation or land subsidence (i.e. soluble carbonate rocks - limestone).

The pipeline route and associated facilities will be aligned to avoid sinkhole occurrence and areas potentially susceptible to karst formation, and the risk of sinkhole development will be minimised through design and selection of appropriate construction methods. A minimum buffer will be established. Design principles to be implemented include:

- Maintaining adequate surface drainage paths; not creating any concentrated water flows; and minimising pooling within the trench and ROW.
- Ensuring adequate non-soluble capping layer thickness (i.e. sandstone).
- Stabilised vegetated cover in areas susceptible to karst formation.
- Routine maintenance during operation to identify and monitor any new sinkhole development, should they occur.

Figure 6-1: Karst features mapped by Karp (2002) in proximity of the KGGP pipeline alignment (KP0-6)

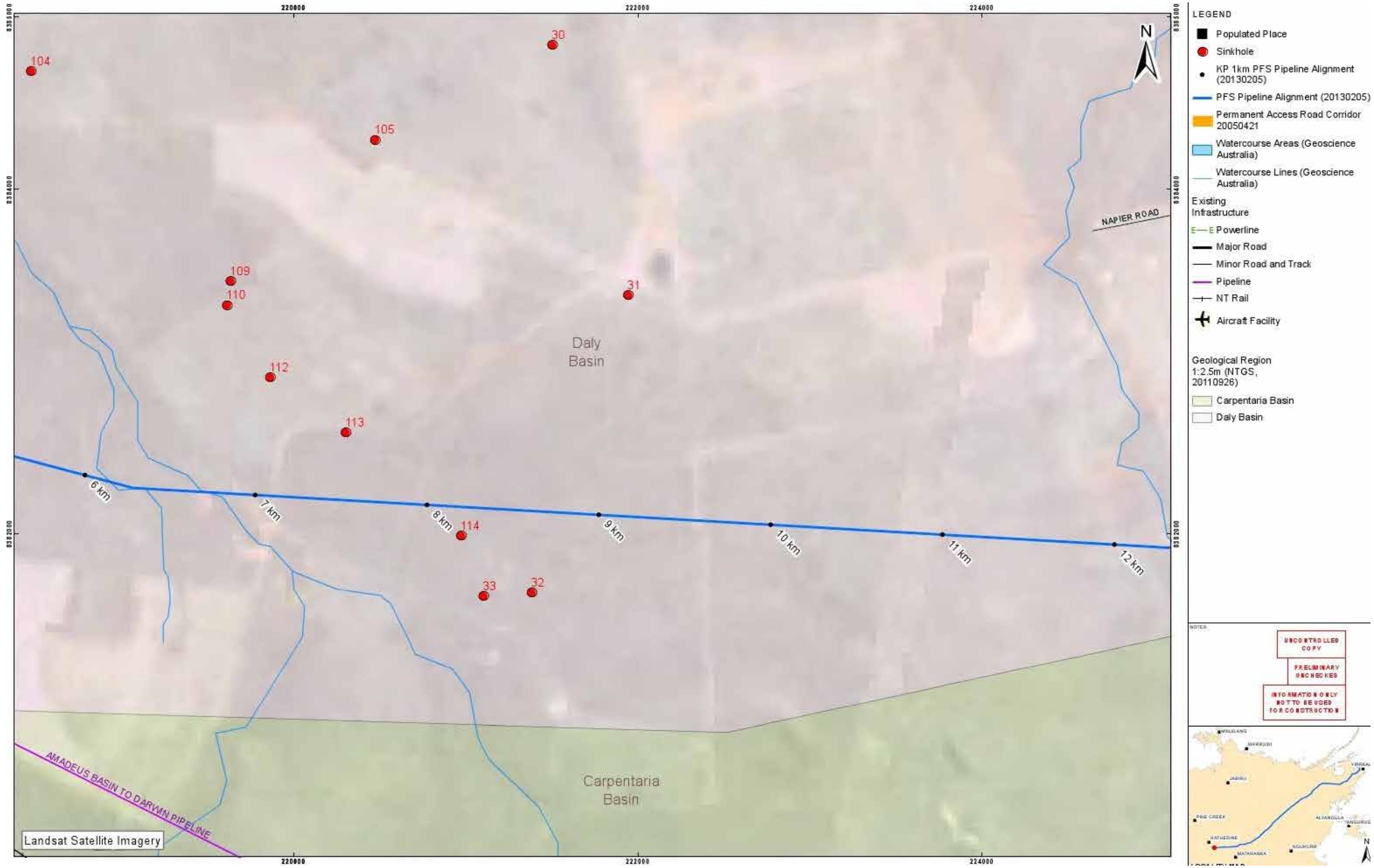


Figure 6-2: Karst features mapped by Karp (2002) in proximity of the KGGP pipeline alignment (KP6-12)

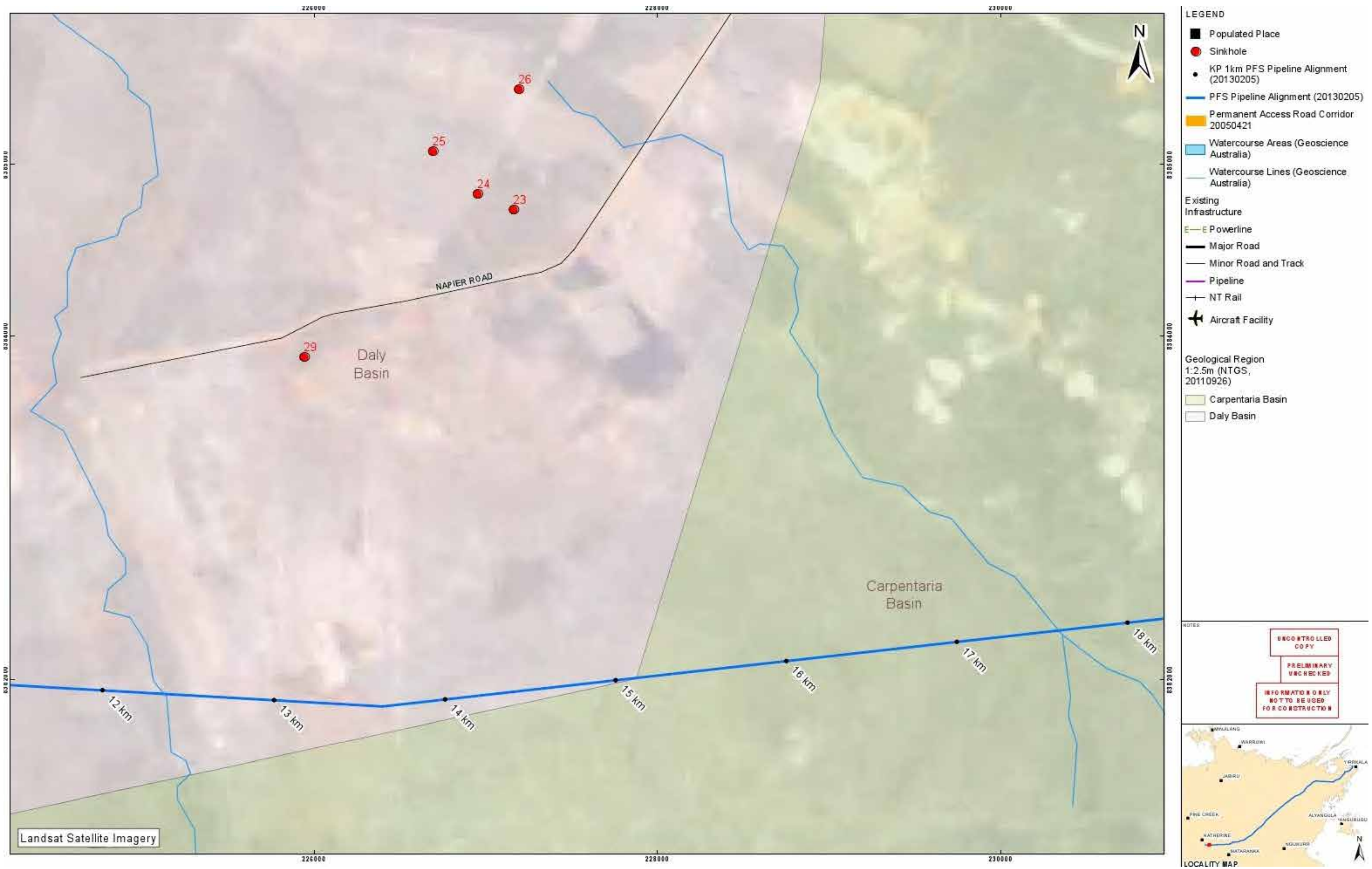


Figure 6-3: Karst features mapped by Karp (2002) in proximity of the KGGP pipeline alignment (KP12-18)

Sensitive soil types (vertosols and hydrosols)

Initial desktop studies indicated Vertosols are likely to be encountered in three short sections within the initial 100 km of the alignment (KP47-49, KP58-60 and KP83-85). Also known as black earths and black cracking clays, these soils are usually associated with arid lands and generally described as clay soils (>35% clay) that swell, shrink and crack as soil moisture varies.

The typical implications for the design and construction of the pipeline in Vertosols are:

- Difficulties with trafficability (i.e. ability for the ground to support a traversing vehicle) following rainfall.
- Shrink / swell movements (differential).
- Erosion.

Where Vertosols are unavoidable, a dedicated access road would be constructed within the ROW or to provide access to the ROW. The dedicated access road would be constructed and maintained through the areas of Vertosol soils to improve the trafficability at the site.

In order to maintain trafficability for all construction machinery throughout the construction period, additional engineering measures (e.g. drainage techniques, use of a geotextile and/or imported gravel cover) will be considered. These management measures would apply along the ROW access tracks and other access tracks connecting to the Central Arnhem Road (noting that these soil types would be avoided through route selection wherever possible (see Site Selection Protocol, Appendix U, Draft EIS).

Drainage measures employed on Vertosol soils may include localised excavations of open 'V' drains on one or either side of the access track to improve drainage and direct surface water away. Local excavated soils and gravels may be used to raise the access track and culvert pipes may be considered to maintain natural surface water flow.

Typically the shrink / swell movements associated with Vertosols have minimal effect on the buried pipeline, as the soil and pipeline move together with moisture variations resulting in minimal strain to the pipeline. At interfaces where the pipeline connects to above ground elements (valves etc.), differential movements may result, causing increased strain on the pipeline. Specific analysis will be undertaken to predict the differential movements, with the pipeline and connections subsequently designed to accommodate these movements.

Hydrosols are shown to be present in two short sections in the central section of the pipeline between KP340-345 and KP361-363. These soils can be saturated for two to three months or more due to local influence. These hydrosol soils can also contain acid sulphate soils (ASS). Assessment and management of ASS is outlined in the following section.

The typical implications on the design and construction of the pipeline in Hydrosols are:

- Difficulties with trafficability.
- Associated with shallow groundwater levels (i.e. Pipeline buoyancy).
- Erosion.

Similarly, where Hydrosols are unavoidable, a dedicated access road would be constructed within the ROW, or providing access to the ROW to improve the trafficability at the site. Trafficability of all access tracks in areas of Hydrosols would be maintained similarly to Vertosols through drainage,

dewatering and additional engineering measures such as geotextile and imported gravel cover. Similar drainage measures employed for Vertosol areas would be used for Hydrosols areas.

Design and construction of the pipeline in waterlogged / saturated soils will also include consideration of:

- Scheduling construction when the area dries out (later in dry season).
- Preparation of the pipeline sections (including welding) ahead of pipeline trenching. This enables the pipe to be lowered immediately upon trench completion to minimise time for collapse, which is a higher risk in saturated soils. Trench boxes can also be used to maintain trench opening.

Detailed geotechnical investigation and testing studies are planned to be undertaken during the 2013 dry season (subject to land access approval) to assess the buoyancy and scour potential of these soil units. Specific design and construction techniques shall be implemented within areas / soil units identified with potential buoyancy and erosion issues.

No additional management or maintenance due to soil type is foreseen during the operation phase of the pipeline, as the pipeline has been designed for these soil conditions in terms of material specification for the pipe wall: Fibre Bonded Epoxy coating and Cathodic Protection.

Acid sulphate soils

A detailed desktop review of existing information has identified areas of potential Acid Sulphate Soils (ASS) in the project area as shown in Figure 6-11 of the Draft EIS. Prior to the commencement of earthworks for the construction of the KGGP, an ASS field investigation is planned in areas considered as having a ‘low to medium’ to ‘high-risk’ of containing ASS. These pronounced areas of “risk” have been recognised using the NT Government’s ASS risk mapping program. An ASS management plan (ASSMP) will be prepared prior to construction, as part of the Construction Environmental Management Plan. The ASSMP will address the management of all ASS, including that identified pre-construction and any identified during construction (as outlined below).

The ASS field investigations are currently proposed to be undertaken in the 2013 dry season.

Preliminary and detailed ASS investigations (i.e. desktop assessment and field-based programs) will significantly minimise the possibility of the construction contractor intersecting unidentified ASS during earthworks. Furthermore, detailed investigations (i.e. sampling and detailed chemical analysis) will identify the degree of sulphidic acidity in the region (if present). Therefore, in the unlikely event that unexpected ASS is intersected, mitigation measures will be implemented to alleviate the situation. This may involve having materials on hand to build bunds in an effort to stop the movement of acid waters and other acidic matter migrating over land to sensitive receptors, e.g. waterways, and having access to buffering materials (i.e. lime) to neutralise any acidity that may have been generated.

The procedure for management of any ASS (or suspected ASS) intersected *outside of the areas* subjected to detailed ASS investigations will be included in the project ASSMP and will include the following:

- Have personnel trained in ASS management observing earthworks.
- Immediate stop work if signs of intersection ASS (organic material, clays etc.) or oxidation products of ASS (iron staining of water, change in soil colour) are detected.

- Isolation: containment of materials that have been excavated and stop any additional removal of suspected soils. It is important to ensure that any soils suspected to be ASS are isolated from surface receptors (i.e. waterways). This includes isolation from potential acidity stored in the soil and minimising turbidity reaching wetlands and other waterways.
- Treatment methods (i.e. application of lime): Having (ready) access to lime (e.g. aglime or a lime slurry) is essential to ensure that, upon visible signs of acidification, lime can be added to the soil so that acidity can be neutralised before any damage to the environment or infrastructure can occur.

Once suspected material has been contained and neutralised (if necessary), the *only* measure that could be used in the field that *may* be used as a proxy for identifying ASS will include:

- Application of pH_F and pH_{FOX} measures (this will be discussed in more detail in the ASSMP). Unless it is visually apparent, there is no way of accurately verifying ASS in the field unless a sample can be supplied to a NATA accredited lab for confirmation.

Construction planning is also being undertaken to estimate potential sources of neutralising ameliorant (e.g. lime) and identify suitable storage sites and ASS treatment locations.

The ASS assessment will be undertaken in accordance with the National guidelines for ASS management, sampling and analysis. The following methodology is proposed:

Boreholes will be drilled or hand augured to a depth of at least 1.0m below maximum likely depth of pipeline construction disturbance at each location (typically 1.2m). Soil profiles will be described and photographed and soil samples will be collected from each profile. Starting from the present ground surface, soil samples shall be collected at intervals not exceeding 0.25m down the profile. Where individual soil units or soil horizons are encountered with a thickness of less than 0.25m, sampling frequency will be increased to ensure that at least one sample is collected from each unit or horizon.

Soil field pH (pH_F) and field oxidation tests (pH_{FOX}) testing will be carried out on all collected samples to provide information about the existing and stored (potential) acidity of a soil profile. Where soils or associated water bodies demonstrate one or more of the following pH_F and/or pH_{FOX} indicators, it can be assumed that ASS is present and further detailed analysis of a soil sample will be undertaken including:

- Chromium Reducible Sulphur (S_{CR}) method (all ASS samples); and
- Total Metal suite (~20% ASS samples).

The results of the detailed laboratory testing will confirm the presence or absence of ASS at each location.

Seismic activity

Typically, the methodology for investigating potential movements and assessing the risk of faults to the pipeline construction and operation include:

- Desktop study to look at identified faults in detail, with topography and aerial / satellite imagery used to assess whether recent fault movements occurred (Present to Quaternary Period) and develop a plan for field inspections.

- Field inspections undertaken by engineering geologists / geotechnical engineers who will look for evidence of fault movement within the bedding of the Quaternary deposits local to the identified faults within the pipeline corridor.
- Where necessary, intrusive investigation typically comprising backhoe excavated trenches across the fault within the pipeline corridor.
- A subsequent comprehensive hazard study, undertaken to mitigate the risk of seismic activity which may impact the pipeline and associated facilities.

Detailed mapping and geotechnical investigation studies and analysis of faults and liquefaction potential have been scoped and are planned to be undertaken during 2013, subject to land access approvals.

Initial investigations have identified 11 known faults cross the current pipeline alignment as shown in Table 6-2.

The initial field studies will include inspections of the listed faults and where necessary instigate appropriate intrusive investigations to determine if fault movement has occurred within the Quaternary period (the last 2.6 million years) given the relatively stable and low regional seismicity (>0.1g : refer AS 1170.4 – 2007) of East Arnhem Land.

Table 6-2: Known faults across the KGGP alignment

	FAULTS				
FAULT NUMBER	*KP (KM)**	*POINT X*	*POINT Y*	*FORM*	*NAME*
1	*94.924*	*304959.900*	*8393548.767*	*fault*	*Unnamed*
2	*157.935*	*361698.590*	*8415609.718*	*fault*	*Unnamed*
3	*163.424*	*366193.688*	*8418556.898*	*fault*	*Unnamed*
4	*173.901*	*373195.433*	*8426346.695*	*fault*	*Unnamed*
5	*192.122*	*386177.381*	*8439132.557*	*fault*	*Unnamed*
6	*335.022*	*490417.324*	*8534643.388*	*fault*	*Unnamed*
7	*414.213*	*550950.122*	*8581768.263*	*fault, concealed*	*Unnamed*
8	*429.285*	*561657.932*	*8591342.077*	*fault, concealed*	*Unnamed*
9	*429.777*	*562063.623*	*8591620.752*	*fault, concealed*	*Unnamed*
10	*435.565*	*566941.078*	*8594663.468*	*fault, concealed*	*Unnamed*
11	*440.763*	*571454.049*	*8597026.954*	*fault*	*Unnamed*

* Based on Rev A of Pipeline Alignment

Published historical seismic events records from the immediate region appear to be less than magnitude 4.0. Examination of the earthquake data relative to the identified faults show there are no apparent correlations within the area on interest. The published geology does not, however, expressly state that these faults are currently active or otherwise.

For those fault lines that are determined to require a design response to mitigate the risk of seismic activity, the following measures will be taken:

- The line pipe will be ordered as API 5L Grade X60 rather than API 5L Grade X70.
- The girth welds will be over-matched on actual pipe strength so that strain is distributed over the girth welds and adjacent pipes, rather than concentrated in the girth welds.
- Loose granular backfill will be used within the pipe trench so as not to restrain movement of the pipeline.

The design will utilise the design concepts of PRCI Report L51927, "Guidelines for the Seismic Design and assessment of Natural Gas and Liquid Hydrocarbon Pipelines"

For areas of liquefaction, it is expected that liquefaction mitigation could be instigated by densification, replacement of material or providing structural strength.

As demonstrated globally, building and operating pipelines safely to mitigate earthquake risk is possible with the acquisition of reliable geologic and seismic data and the use of those data in design and construction. The necessary data will be acquired over the course of the project to confirm that appropriate design techniques are selected and applied.

6.2.3 Watercourse crossings

Further detail of the nature of river crossing techniques and mitigation measures to be applied to maintain bank stability and watercourse profile was requested by a number of respondents to the Draft EIS. Respondents highlighted the sensitive nature of riparian and aquatic habitats to be traversed through the pipeline region and emphasised that construction techniques at watercourse crossings must be of the highest standard. Concerns regarding potential impacts on the threatened Freshwater Sawfish were raised. Many respondents supported the use of Horizontal Directional Drilling (HDD) crossing techniques and put forward the view that this technique should be used for more of the major river crossings (than the nine committed to in the Draft EIS), rather than open trenching techniques. The rationale for selecting these nine river crossings was questioned along with the criteria by which the constructor would determine whether other watercourses were 'in-flow' and therefore potentially also subject to consideration of HDD. The following additional information is supplied in response to these concerns.

Watercourse crossing techniques

Watercourse crossings will be undertaken to a high standard using industry best practice methodologies. Each water course will be studied in detail during field investigations prior to construction to confirm the most appropriate construction methodology and rehabilitation strategy to ensure the best environmental outcome is achieved. Field investigations will include assessment of existing soil/ground conditions, current river bank profile and condition, river flow levels, and vegetation assessment. The Australian Pipeline Industry Associations (APIA) Code of Environmental Practice for Onshore Pipelines (May 2013) will continue to be consulted to guide the project on suitable crossing methodologies, reinstatement and rehabilitation measures. The APIA Code provides guidance on the industry best practice techniques/methods presently available to mitigate the environmental impact based on the collective current knowledge and experience of the Australian pipeline industry.

Open-cut trenching and Horizontal Directional Drilling (HDD) were proposed in the Draft EIS as the preferred construction methods for crossing watercourses. Table 2-6 of the Draft EIS “Indicative Horizontal Directional Drilling (HDD) river crossings” lists the nine river crossings proposed to be crossed by HDD and their associated justification.

Further development of the strategy for watercourse crossings has been undertaken to provide a clearly defined and robust ‘Risk Assessment and Adaptive Management’ (RAAM) methodology for the selection of watercourse crossing construction techniques at each watercourse. In addition to the Draft EIS data, the RAAM has incorporated recently available information from the following sources:

- Comments received on the Draft EIS.
- Weather assessment.
- Further design consideration.
- Consideration of additional mitigation measures to protect the Freshwater Sawfish (listed as Vulnerable under the EPBC Act and TPWC Act).

The RAAM strategy is outlined below. Pacific Aluminium will oversee implementation of this process during the course of construction, through the management framework and processes set out in Chapter 17 of the Draft EIS and expanded upon in section 6.2.1 of this EIS Supplement.

<u>Risk Assessment and Adaptive Management (RAAM) Strategy - Overview</u>

Open cut trenching is a standard industry practice and is anticipated to be the primary crossing method for watercourses during construction of the KGGP. The open cut trenching method is generally applied in *‘dry or shallow low flow watercourses, but may also be applied in sensitive watercourses where rapid construction is considered the best means of minimizing environmental impacts’* (page 65 of APIA Code of Environmental Practice, May 2013). The technique involves in-stream excavation of a trench in the standard manner. Excavators or backhoes are generally used for this technique, enabling trench spoil to be stockpiled away from the stream bed. The prefabricated pipe is placed across the waterway, lowered in and trench backfilled immediately. Figure 6-4 shows a typical profile for installation of the pipe within a minor watercourse subject to open cut techniques. In a dry or low flow watercourse, construction of the crossing is rapid and would be achieved in one day or less.

A weather assessment has been undertaken and current scheduling of construction is based on statistical median weather conditions across the project area, utilising the advice of the Bureau of Meteorology’s consulting services. The Bureau advises that conditions tend to be more predictable three months ahead of weather events, with precision of prediction improving as the forecast time gets shorter. The statistics indicate that once the wet season has finished, there is a distinct window in which construction can be reliably carried out. The weather assessment and preliminary reconnaissance of the project area during the 2013 dry season therefore provide an adequate level of confidence that for median dry season conditions, the water course crossings (not already identified as HDD crossings) would be dry or in low flow conditions (which would facilitate the use of standard open cut techniques of up to one day open trench/in-stream construction duration).

Significantly higher than average wet season rainfall preceding the construction phase could result in flows for some watercourses extending later into the dry season. Consistent with the RAAM strategy, where practicable, crossing of the watercourse will be delayed until such time as a dry/low flow crossing can be undertaken using standard open cut crossing techniques. Where the on-ground risk assessment indicates that the use of standard open cut techniques (duration up to one day in respect

of in-stream disturbance) is not suitable, alternate crossing techniques (including flow diversion open cut or HDD) will be considered, as illustrated in Figure 6-5.

The watercourse crossing techniques selected for the KGGP project will balance the overall disturbance footprint with site specific constraints, noting that although HDD has considerable benefits in avoiding in-stream and riparian habitat, when compared to open cut techniques, this method is costly and usually proposed for major river crossings. HDD can also be limited by geotechnical or physical constraints and its adoption can introduce additional environmental risks such as management of drilling muds. In some cases additional access tracks (and associated vegetation clearing) would also be required to transport the HDD equipment from the Central Arnhem Road to the crossing site, which results in greater overall vegetation clearance and ground disturbance. It is therefore incorrect to assume that in every circumstance, all environmental impacts from HDD are less than from trenching.

The construction methodology to be applied at those watercourses not already identified as HDD will therefore be determined by the RAAM process, continuously applied, reviewed and updated throughout the design and construction of the KGGP. The RAAM approach will take into account:

- Environmental conditions.
- Social/cultural considerations.
- Engineering factors.
- Location specific factors relevant to each crossing.
- Ground conditions.

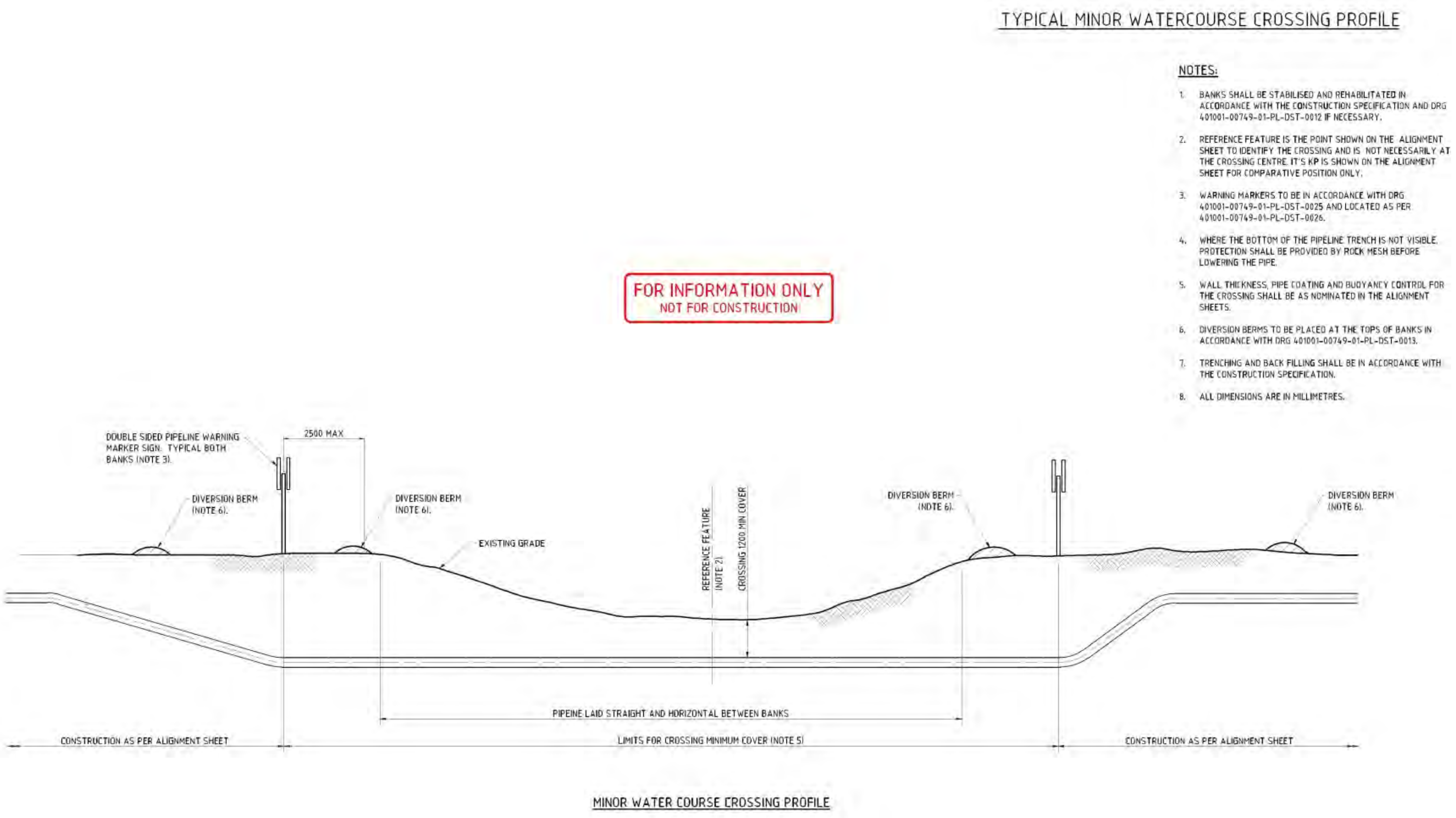


Figure 6-4: Profile of minor watercourse subject to open cut crossing for installation of pipe

RAAM Strategy – Engineering and Design Phase

The initial risk assessment has been based on currently available information, and the crossing methodology proposed to be undertaken for each watercourse has been based on the anticipated conditions at each location at the time of construction. The crossing methodology risk assessment will be further developed during detailed design, upon receipt of survey information and the outcome of commissioned flood modelling and river morphology study (erosion and scour risk assessment). This work is scheduled toward the end of 2013. Aerial photography / LIDAR survey will also be undertaken and an elevation model developed. These studies will provide information regarding:

- Catchment details.
- Waterway flow regimes.
- Water flow and volume expected at each crossing.
- Areas of potential flooding.

Determination of the final alignment within the approved 100 m pipeline corridor will follow the 'Site Selection Protocol' and will aim to avoid waterway or wetland crossings where possible and alternatively to select crossing locations and methods to minimise impact.

Bed and bank profiles will be developed following site survey of the crossings, planned at the end of 2013. Final crossing location (excluding minor crossings) within the pipeline corridor will be identified through an onsite assessment. Determination of the final crossing locations within the approved pipeline corridor would involve a range of considerations including but not limited to:

- Constructability.
- River/crossing hydraulics, flooding and morphology.
- Environmental considerations such as width and condition of riparian vegetation.
- Soil conditions.
- Accessibility.
- Crossing approaches.

The final crossing locations, within the 100m corridor, will be determined during detailed design and shown on the alignment sheets.

RAAM Strategy – Construction Phase

The final stage of risk assessment will occur immediately prior to construction of the watercourse crossings in order to take into account the current, site-specific conditions. Each watercourse crossing will be reviewed and construction methods revised as required. Specific considerations at this risk assessment stage will include:

- Stream flow volume (if any), velocity and rate.
- Watercourse profile (as may have changed over the previous wet season).
- Ground conditions including substrate permeability. This method is generally applied at crossings where water flow is required to be maintained for ecological, social or engineering reasons.
- Environmental aspects such as predicted impact on aquatic biota, riparian vegetation and general vegetation clearing for additional workspace (HDD).

- Social/cultural aspects.
- Other safety and engineering aspects.

Should a watercourse (not already identified for HDD) be in flow at the time of construction, application of the RAAM strategy would initially consider delay of the crossing until dry/low flow crossing using standard open cut crossing technique can be accommodated. Where this is not possible (due to predicted weather conditions and construction scheduling) the appropriate crossing technique for the watercourse will be determined by further applying the RAAM strategy. Assessment of flow conditions and the application of the RAAM strategy to determine watercourse crossing methodology will be undertaken with sign off from the Manager HSE (or their delegate) for the KGGP Project.

A summary of the RAAM Strategy for watercourse crossings is provided in Figure 6-5

<u>Specific RAAM Strategy - potential Freshwater Sawfish habitat</u>

A specific risk assessment and adaptive management processes will be put in place if a watercourse could potentially provide habitat for the Freshwater Sawfish. These arrangements are as follows:

- Consideration of the preliminary risk assessment of river crossings likely to provide suitable habitat for Freshwater Sawfish, which has identified 24 watercourses in the project area where the species is ‘likely’ or ‘possible’. This risk assessment was conducted with advice from an expert on Freshwater Sawfish in the Northern Territory and was included in Chapter 10 and Appendix Q of the Draft EIS. The risk assessment addressed broad habitat suitability from a catchment perspective. Actual risks to Freshwater Sawfish would be dependent on the conditions at the point of crossing at the time of construction.
- With the exception of Flying Fox Creek, all crossings where suitable habitat for Freshwater Sawfish have been assessed as ‘likely’ have already been identified as requiring HDD crossing techniques. This avoids in-stream disturbance from construction.
- If in flow at the time of construction, consideration will be given to use of HDD at the Flying Fox Creek crossing, subject to the general risk assessment and adaptive management processes outlined above.
- For the Flying Fox Creek and the crossing of the other 20 watercourses assessed as providing ‘possible’ suitable habitat for Freshwater Sawfish, further risk assessment and mitigation will be undertaken as follows:
  - An independent and recognised Freshwater Sawfish expert will assess the specific proposed location of each watercourse crossing for habitat suitability for the species.
  - If the expert determines that the crossing site does not provide suitable habitat, the general risk assessment and adaptive management processes for determining crossing technique (described above) will apply.
  - If the expert determines that there remains a risk that suitable habitat for the Freshwater Sawfish is possible at the site due to flow conditions and habitat quality, construction of that crossing will be deferred and completed by open cut techniques at a later date when the crossing is deemed to be dry.
  - In the very unlikely event that a crossing assessed as providing suitable habitat that is in flow cannot be deferred until it is dry, then a further risk assessment will be undertaken with priority given to consideration of HDD, or open cut techniques in which impeded or diverted flow are limited to one day. The risk assessment of crossing methodology in these

circumstances or where a longer period of flow diversion may be necessary, would be specifically informed by a suitably qualified person with expertise in Freshwater Sawfish.

- The final watercourse crossing technique will be undertaken with sign off from the Manager HSE (or their delegate) for the KGGP Project.

The above risk assessment and adaptive management process for Freshwater Sawfish and watercourse crossing selection is documented in a decision tree (Figure 6-6). The likelihood of Freshwater Sawfish occurrence and likely watercourse construction method is provided in Table 6-3, noting that the selection of final construction technique is subject to the risks analysis process including site specific assessment.

Table 6-3: Proposed watercourse crossing techniques for potential Freshwater Sawfish habitat

RIVER NAME	LIKELIHOOD OF OCCURRENCE	FRESHWATER SAWFISH HABITAT	PROPOSED CROSSING METHODOLOGY (DESIGN PHASE – RISK ASSESSMENT)
Freshwater river/streams either with permanent water or potentially some pools/waterholes in dry season			
King River	Unlikely	Too far inland with no connection to a tidal river.	HDD: Deep and wide river channel with steep banks that could be difficult to stabilise and rehabilitate.
Roper Creek	Possible	Connects to Roper River where FWS have previously been recorded.	Open Cut Crossing
Beswick Creek	Possible	Permanent waterholes exist that may provide suitable refuge for juveniles and sub-adults during the dry season.	Open Cut Crossing
Waterhouse River	Possible	Tidal connections (Roper) and contains waterholes upstream from the pipeline that persist during the dry season (i.e. Alligator Waterhole).	HDD: Riparian vegetation and in-stream habitat of conservation significance – potential for significant impacts if construction machinery is transported across multiple braided channels.
Chambers River	Possible	Tidal connections to Roper River where Freshwater Sawfish have previously been recorded.	Open Cut Crossing
Bukalorkmi creek	Possible	Middle reaches of watercourse, connects to Roper River and extensive floodplains.	Open Cut Crossing
Maiwok Creek	Possible	Connects to a floodplain and permanent waterholes exist at Dulcaruk Billabong that may provide suitable refuge. Tidal connections to Roper River.	Open Cut Crossing
Flying Fox Creek	Likely	Freshwater Sawfish previously recorded upstream of the pipeline.	Open Cut Crossing
Quibobikwi Creek	Possible	Upper reaches of watercourse, extensive floodplains that have tidal connections (Roper River).	Open Cut Crossing
Mainoru River	Likely	Previously recorded. Middle reaches of estuary and connects to tidal river	HDD: Riparian vegetation and in-stream habitat of

RIVER NAME	LIKELIHOOD OF OCCURRENCE	FRESHWATER SAWFISH HABITAT	PROPOSED CROSSING METHODOLOGY (DESIGN PHASE – RISK ASSESSMENT)
		(Roper).	conservation significance – potential for significant impacts if construction machinery is transported across multiple braided channels.
Horse Creek	Possible	Middle reaches of estuary and connects to a floodplain and a tidal river (Roper).	Open Cut Crossing
Wilton River	Likely	Previously recorded. Middle reaches, connects to tidal river (Roper).	HDD: Riparian vegetation of conservation significance. Deep river channel with steep banks – specific attention is required to stabilise and rehabilitate. Note that access road across the river, adjacent to proposed pipeline alignment, would be used to transport equipment across river.
Jasper Creek	Possible	Upper reaches. Connects to Wilton River which connects to tidal river (Roper).	Open Cut Crossing
Annie Creek	Possible	Connects with tidal river (Goyder) and likely to have refuge pools and upstream billabongs that would persist through the dry season providing suitable habitat.	Open Cut Crossing
Branch of Annie Creek	Possible	Middle reaches. Connects to Goyder which is likely to have refuge pools and upstream billabongs.	Open Cut Crossing
Goyder River	Likely	Anecdotal evidence exists of occurrence although from downstream of the pipeline. Likely to have refuge pools and upstream billabongs.	HDD: Riparian vegetation and in-stream habitats of conservation significance - potential for significant impacts if construction machinery is transported across multiple braided channels. Deep river channel with steep banks – specific attention is required to stabilize and rehabilitate.
Badalngarrmirri Creek	Possible	Upper reaches of Goyder River. May provide refuge pools and upstream billabongs that would persist through the dry season.	Open Cut Crossing
Dubumirrami Creek	Possible	Upper reaches of Goyder River. May provide refuge pools and upstream billabongs that would persist through the dry season.	Open Cut Crossing
Unnamed watercourse	Possible	Tributary of Goyder River. May provide refuge pools and upstream billabongs that would persist through the dry	Open Cut Crossing

RIVER NAME	LIKELIHOOD OF OCCURRENCE	FRESHWATER SAWFISH HABITAT	PROPOSED CROSSING METHODOLOGY (DESIGN PHASE – RISK ASSESSMENT)
		season.	
Habgood River	Possible	Upper reaches of estuary with tidal connections.	Open Cut Crossing
Latram River	Possible	Middle reaches of estuary. Lower reaches may be too saline for juveniles and sub-adults, but middle to upper reaches may provide suitable refuge.	HDD: Known habitat of *Pternandra coerulescens*, a plant species listed as Vulnerable under NT legislation. High level of recreational use as a waterway. Riparian vegetation and in-stream habitat of conservation significance.
Non-freshwater (i.e. estuaries) or rivers/streams likely to have no water at all in dry season			
Buckingham River	Possible	Upper reaches of estuary.	Open Cut Crossing
Goromuru River	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.	Open Cut Crossing
Branch of Goromuru River	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.	Open Cut Crossing
Branch of Goromuru River	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.	Open Cut Crossing
Boggy Creek	Possible	Upper reaches of large river. Appears to have substantial freshwater that will become disconnected billabongs in the dry season.	HDD: Riparian vegetation and in-stream habitats of conservation significance. Deep river channel. Potential for impacts on hydrology of waterhole that has a small outflow.
Cato River	Unlikely	There is anecdotal evidence of Freshwater Sawfish occurring in the Cato River; however, these records are from far downstream of the proposed pipeline. The upper reaches are likely to be completely dry during the dry season, and it is unlikely that the sawfish occurs in this watercourse anywhere near the pipeline.	HDD: Riparian vegetation and in-stream habitats of conservation significance.
Giddy River	Possible	Upper reaches of estuary. Possible refuge and likely passageway for juvenile and sub-adults.	HDD: Riparian vegetation and in-stream habitats of conservation significance – potential for significant impacts on the vegetation island in the river channel. Banks require specific attention to stabilise and rehabilitate.
Wonga Creek	Possible	Upper reaches of estuary that may	Open Cut Crossing

RIVER NAME	LIKELIHOOD OF OCCURRENCE	FRESHWATER SAWFISH HABITAT	PROPOSED CROSSING METHODOLOGY (DESIGN PHASE – RISK ASSESSMENT)
		provide refuge for juveniles and sub-adults in billabongs during the dry season.	

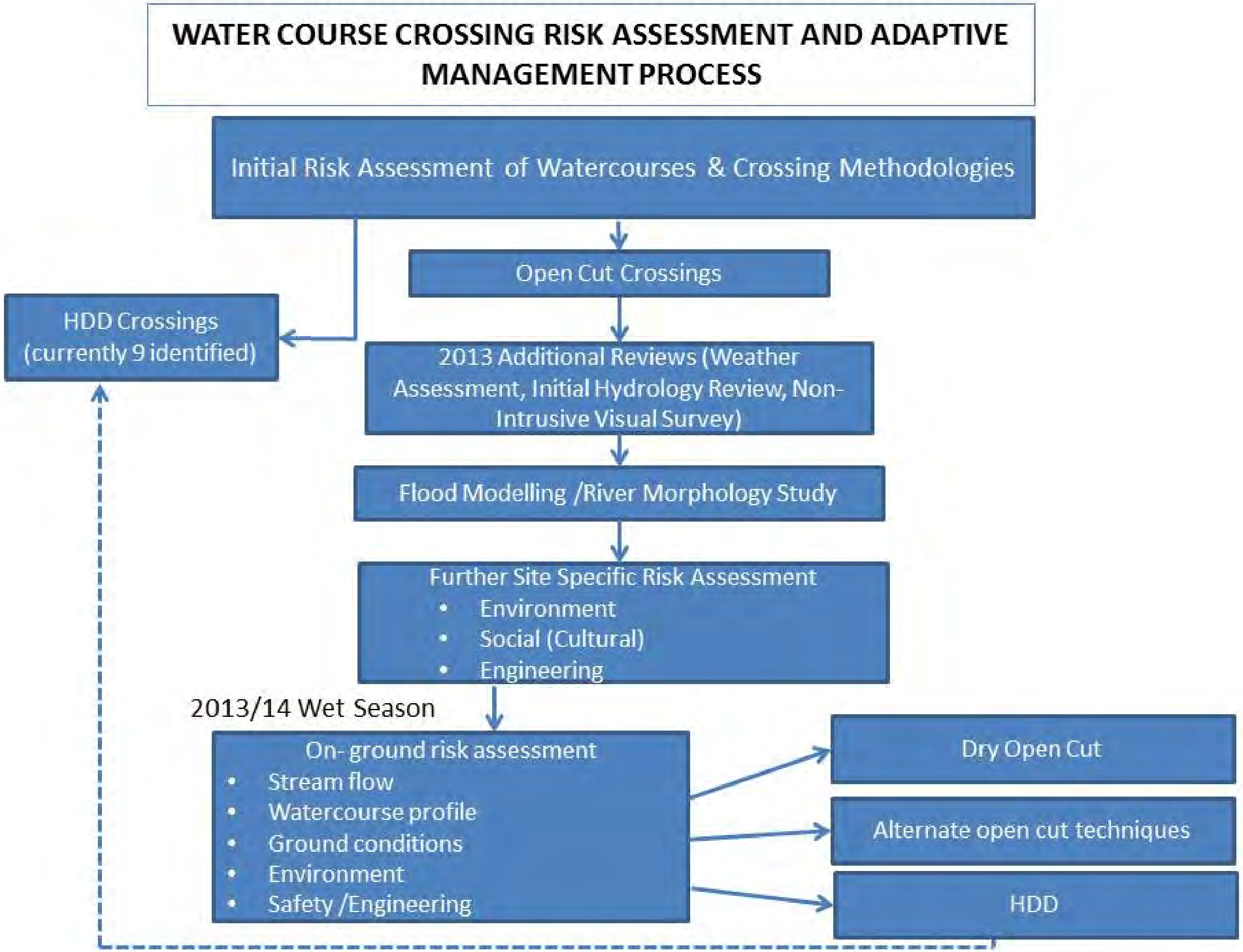


Figure 6-5: Risk Assessment and Adaptive Management Process for watercourse crossings

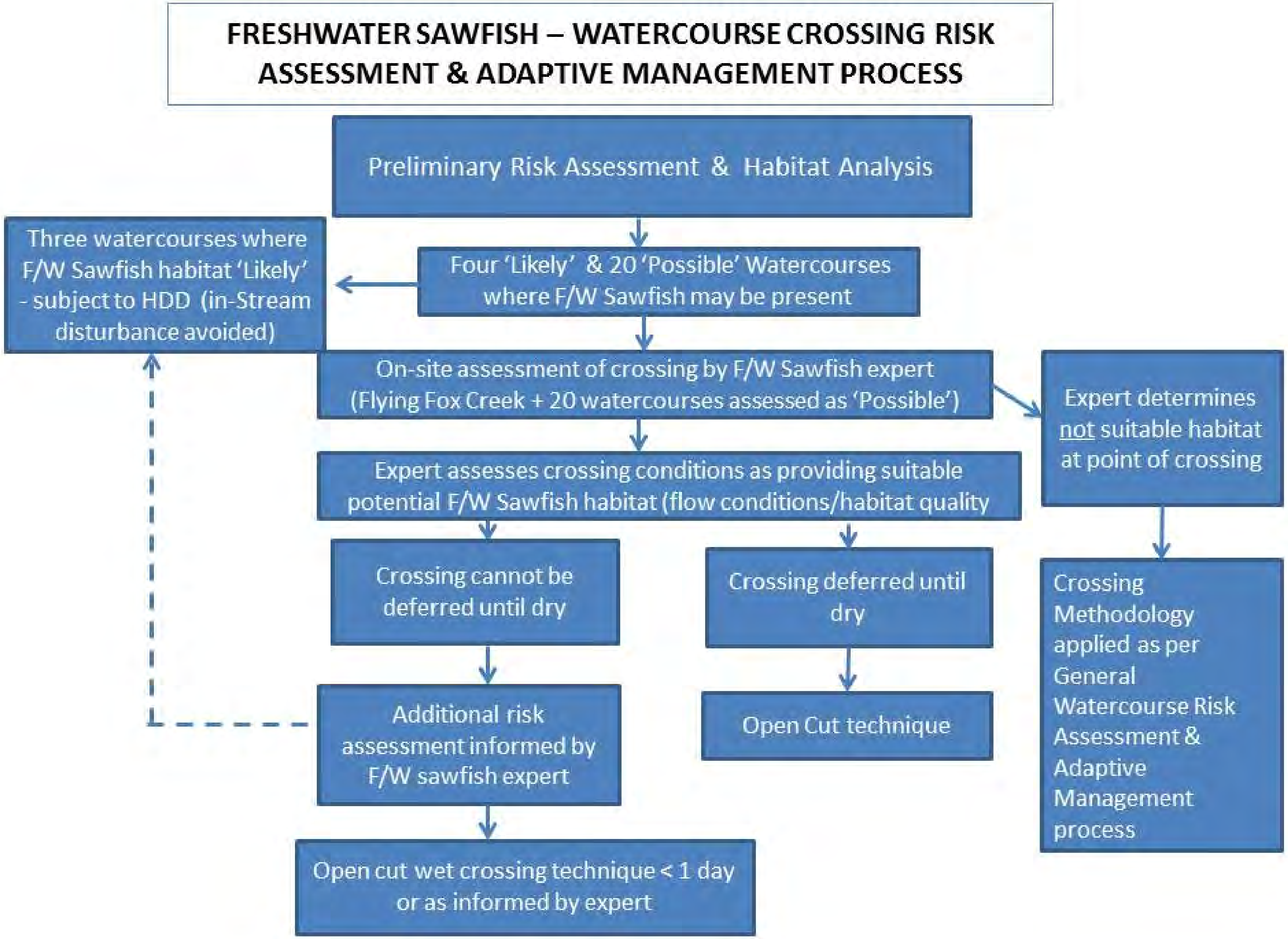


Figure 6-6: Risk Assessment and Adaptive Management Process for watercourse crossings providing potential habitat for Freshwater Sawfish

Additional detail: construction of HDD crossings

Geotechnical investigations are planned (subject to landholder consent) during the design phase at HDD locations to ensure suitable HDD design and construction techniques are employed specific to each crossing. In the absence of geotechnical data, conservative technical assumptions have been made at HDD locations regarding existing ground conditions. These assumptions will be appropriately validated and/or revised once suitable investigations are completed for the HDD sites.

A special construction crew is dedicated to the construction of watercourse crossings by HDD. These crews will operate independently of the mainline construction crew and will construct crossings at the optimum timing for ground and water flow conditions and construction schedule.

For the nine rivers (King, Waterhouse, Mainoru, Wilton, Goyder, Boggy, Cato, Giddy, Latram) that are proposed to be crossed by HDD, these will be undertaken in sequence commencing in Katherine with completion in Gove or as the project planning requires.

At each watercourse subject to HDD, ground investigation drilling would be undertaken. From this information, the crossing may be designed and the length and depth determined. HDD is not preferred for gravels, cobbles and boulders due to constructability concerns.

Once the HDD is designed, the distance to each side of the river bank will be known and the design will ensure that the riparian vegetation is not disturbed or damaged. Dedicated access tracks to these HDD locations will be constructed to permit access for the investigation drilling rig and later for the access of the HDD equipment. Investigations are underway on the potential use of temporary bridges to enable vehicle and equipment access across the river without the need for construction of significant amounts of additional access track (see section 6.2.6 of this EIS Supplement).

The 50 m x 40 m working surface at the rig side would be cleared of topsoils, and topsoils stored ready for future reinstatement.

The identified areas will be marked with high visibility fence or tape, and equipment mobilised to the entry side of the HDD and installed ready for the HDD operations. This equipment will enter and exit through the dedicated access tracks.

On the opposite bank where the HDD will exit, the section of the pipeline to be pulled under the river bed will be welded together, coated and pre-hydro tested ready for the pulling operation once the tunnel has been completed. This section of the pipeline is called the string.

On completion of the tunnelling operation and the pulling of the string through the tunnel from the exit point to the entry point, the tie-in of the HDD to the mainline may now commence. Pipes are bent to make the transition piece between the HDD string and the main line.

In the event of the geology being unsuitable at the HDD crossing point, the following construction options would be considered:

- Change the location of the HDD crossing to a new location where there is more favourable geology.
- Undertake the crossing by an ‘open cut’ method in controlled circumstances depending on the river flow – restricted working width would apply.
- Defer construction where possible until watercourse in low flow/dry and able to be crossed by ‘open cut’ methodology – restricted working width would apply.

Risks to aquifer cracking from HDD

Risks to aquifers from the construction of watercourse crossings using HDD are managed through site specific assessment during design and construction according to the following considerations:

- Geotechnical assessment (including boreholes either side of each watercourse crossing) will provide details of ground conditions and potential for encountering geological layers that may contain groundwater / aquifers for the HDD crossing.
- The geotechnical assessment, together with the topographical survey will inform the detailed HDD design for each HDD crossing. This will be used to generate a fracture gradient analysis for each hole.
- By assessing the borehole data, the HDD bore profile can be adjusted to avoid identified problems.
- Additionally geological layers such as sand or gravels which are more difficult to stabilise in HDD operations will be avoided through a detailed design for each crossing.
- The HDD crossings are all relatively shallow – i.e. less than 12 m below ground level, and there is little if any elevation change between entry and exit of the borehole. There is no likelihood of disturbing a typical subterranean aquifer as the drilling will only be in the near surface groundwater regime.
- The drilling fluid is freshwater and bentonite (a naturally occurring clay). One significant property of the bentonite is its ability to form a “filter cake” on the wall of the HDD borehole to prevent the ingress of ground water into the HDD borehole and further, to prevent leakage of drilling fluid out of the HDD borehole. Bentonite is often used to seal dams and construct diaphragm walls.
- As the drilling fluid has a slightly higher specific gravity than the surrounding groundwater (approximately 1.1), there is a slight positive pressure exerted on the borehole wall that will prevent water ingress.
- During the actual drilling operation, the fluid pressure in the annulus will increase due to the flow of fluid along the borehole. By utilising the geotechnical information from the coring logs, the annular fluid pressure will be modelled and compared to the formation fracture pressure. Fracture pressure is the pressure at which the ground will “crack” and allow the drilling fluid to escape the borehole.
- By controlling fluid flow in the hole and hole diameter, the drilling fluid will not escape the borehole into the surrounding groundwater.
- Particular care and risk management are undertaken to ensure the fracture window size is adequate and fracture pressures are controlled.

Methods for reinstatement, erosion control and ensuring stability of river crossings

All watercourses will be rehabilitated after pipeline installation to prevent erosion of the trench line. Correct reinstatement is essential for the longevity of the pipeline in addition to ensuring minimal impact on the surrounding environment. The following studies will be undertaken prior to construction and will identify areas of potential inundation and susceptibility to erosion along the pipeline route:

- Flood study
- River morphology/scour protection study.
- Soil assessment and erosion/sediment control field investigation.

Rehabilitation methods will be informed by these studies and ensure the appropriate methods are selected to minimise impact on the surrounding environment and prevent erosion of any trenched areas or crossings.

Erosion management and rehabilitation of watercourses subject to open trenching construction techniques will be undertaken on a site-specific basis with the objective of reinstating the watercourse as close as possible to the pre-construction, natural profile and ensuring a stable landform is achieved. Erosion and scour protection measures will be applied where necessary to ensure stability of the bed/banks and prevent the pipeline from exposure and mechanical damage due to scour. Subject to site-specific assessment, options for scour and erosion protection measures to ensure bank stabilisation will include:

- Appropriate selection of backfill material.
- Achieving appropriate levels of soil compaction.
- Respreading topsoil over area from which it was removed and seeding areas of disturbance.
- Replacing or introducing a surface layer of cobbles, coarse gravel or rock over disturbed area as rip rap.
- Use of jute mesh or geosynthetic lining.
- Spreading light, stockpiled timber over area leading down to watercourse crossing.
- Installing surface water diversion / contour banks.
- Applying sandbag, trench breakers, gabion or other means of scour protection.
- Preventing access to site using fences/barriers to assist site recovery.

The reinstatement of the crossings shall be guided by the International Erosion and Sediment Control (IESC) guidelines and other industry best practice guidelines (for example the APIA Code). The approach to watercourse reinstatement including construction of erosion and scour protection measures shall aim to minimise alteration to the hydrodynamic profile of the watercourse as far as practicable. The locations of the watercourse crossings will be selected to ensure they are appropriately located to avoid features that are likely to be more susceptible to erosive forces. A combination of erosion and scour protection measures are applied to each individual crossing, taking into account existing conditions at the time of construction, to achieve the final landform stabilisation and rehabilitation. The methodologies employed will be in accordance with the approved Construction Environmental Management Plan (CEMP) and will meet the requirements and conditions of the NT EPA / government regulatory agency. Figures 6-7 and 6-8 show the typical bank restoration and stabilisation treatments, respectively, for open cut crossings of watercourses.

In addition, sediment control measures will be employed to minimise adverse downstream impacts in the watercourse. Subject to site specific assessment, options for sediment controls will include:

- Sediment / silt barriers which are generally constructed from geotextile silt fence or filter fabric secured in place with star pickets or sand bags, concrete saddle bags or culverts.
- Sediment basins generally constructed on the downslope and designed to catch and retain run-off water, allowing sediment to settle out.

After the completion of construction works and the first wet season, the condition of all watercourse crossings will be evaluated and remedial repair works undertaken where necessary. Ongoing evaluation will occur as part of the pipeline operation and maintenance procedures. Patrolling of the pipeline corridor for indications of subsidence, erosion or scour shall be undertaken on a routine basis and after significant rainfall events. Patrolling shall be undertaken by flight and/or ground crews as

necessary. Areas identified as having scour or subsidence shall be investigated and repaired as soon as possible in accordance with maintenance procedures. Typically repair of surface scour involves maintenance, replacement and/or installation of additional scour controls. Trench material will be replaced, compacted and reinstated in areas of subsidence.

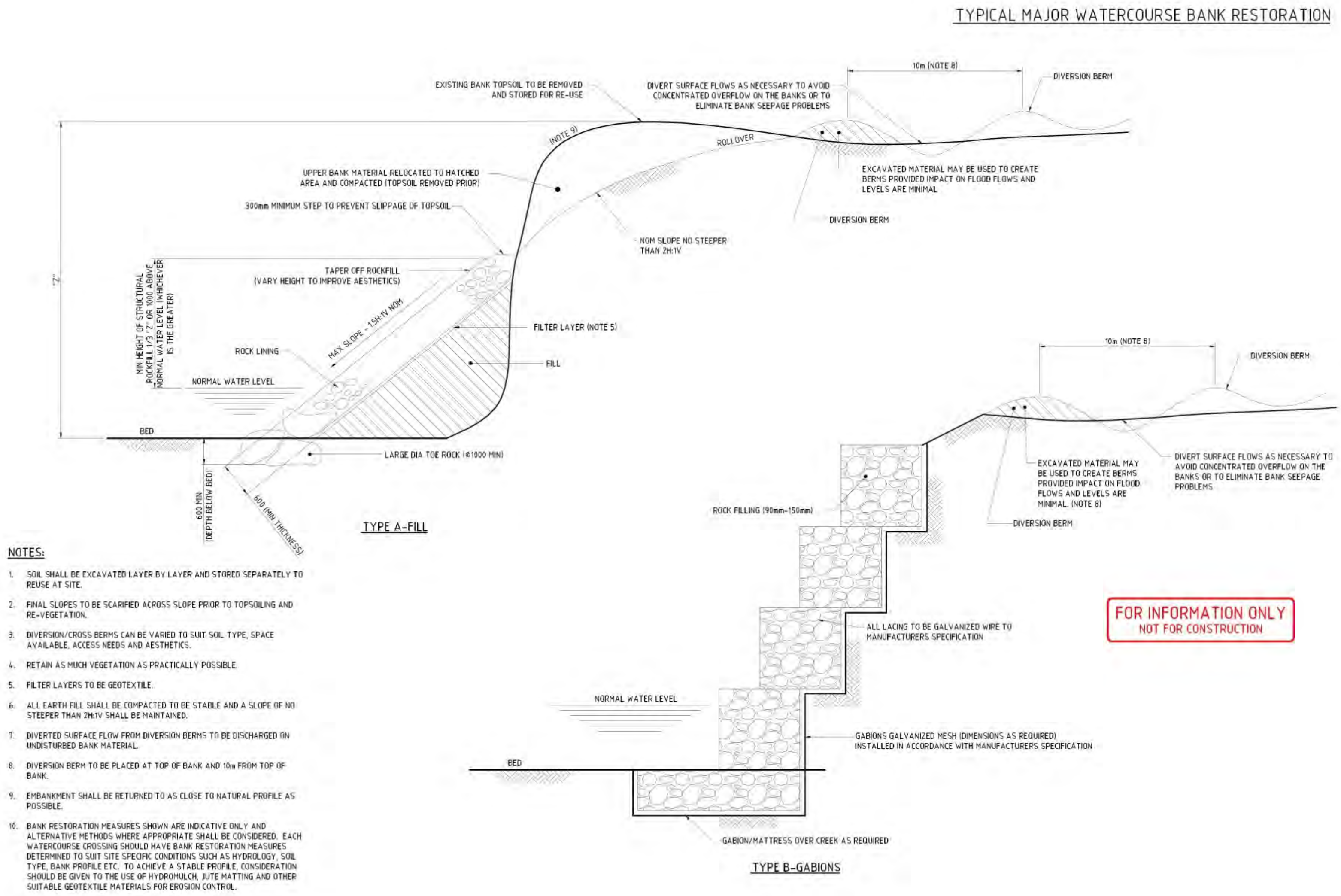


Figure 6-7: Typical bank restoration treatments for open cut of a major watercourse

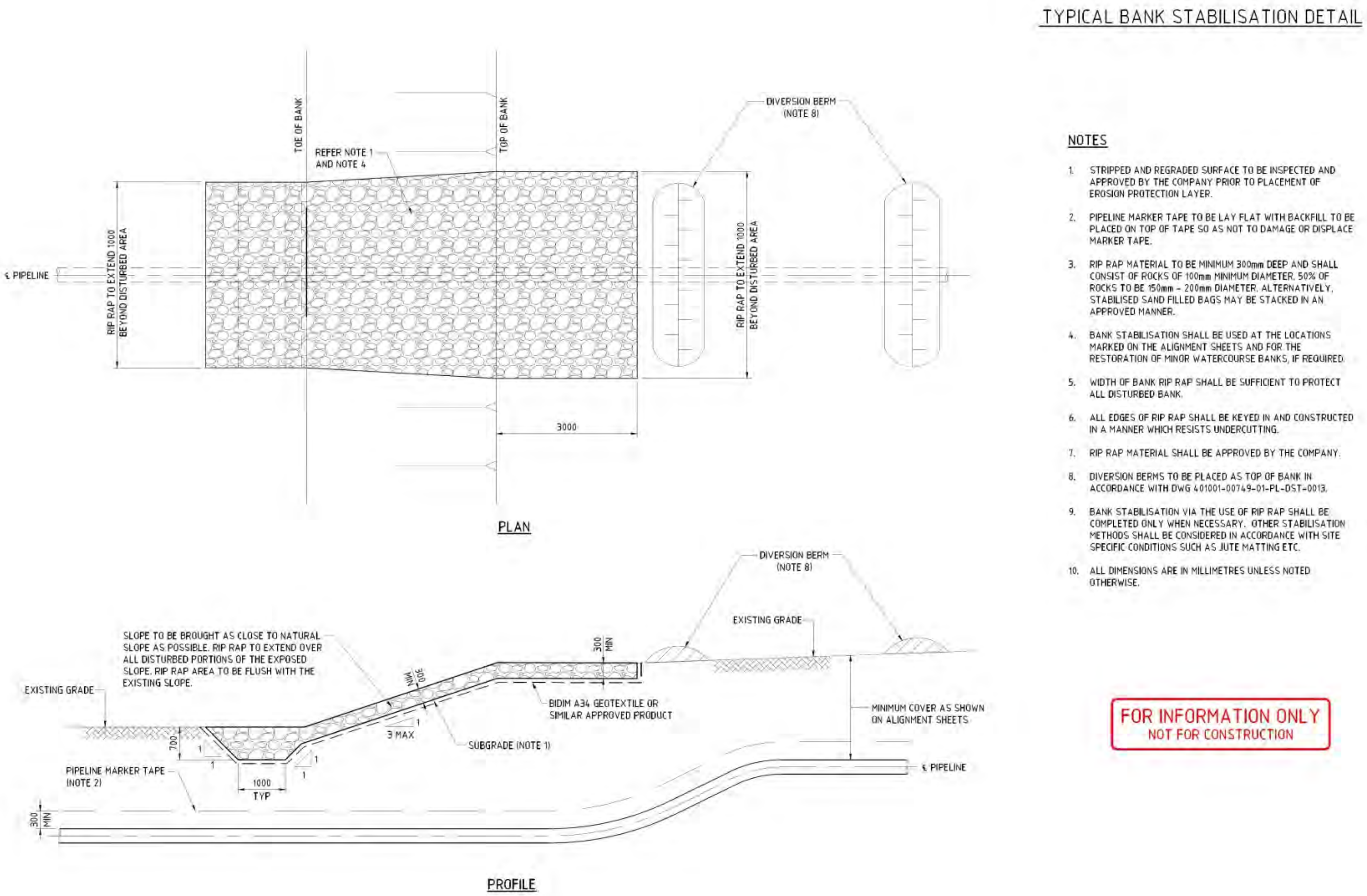


Figure 6-8: Typical bank stabilisation treatments for an open cut watercourse.

Buoyancy control

The design and construction of the KGGP would include various procedural and physical measures in areas of watercourses, wetlands and flood inundation for pipeline protection and buoyancy control. Buoyancy control measures are installed to ensure that the pipeline maintains negative buoyancy in areas under crossings such that the pipeline does not move from its designed position and float towards the surface. The physical protection and buoyancy control measures that will be considered during detailed design and construction include:

- Additional depth of cover.
- Heavier wall thicknesses in areas of HDD's.
- External abrasion coating in areas of HDD's.
- Concrete weight coating (buoyancy control and scour protection).
- Set on weights for buoyancy control.
- Geotech fabric control.

None of the above measures will lead to any changes in the profile of the watercourse.

The procedural protection measures include regular visual easement monitoring to ensure the integrity of the pipeline system is maintained. The pipeline construction method and easement reinstatement / rehabilitation techniques at each of the crossings will be determined during the detailed design and optimised during construction on completion of ground intrusive investigations to be conducted during 2013 and flood modelling studies.

As the KGGP would be buried to a depth of 1200 - 2000 mm for open cut water course crossings and deeper for horizontal directional drill (HDD) crossings, the buoyancy control measures will not be exposed under design conditions and therefore will not impact the hydrodynamics of the watercourse.

Pipeline coating

The KGGP will be externally coated with a dual layer fusion bonded epoxy (FBE) coating. Pipe used for open cut waterway crossings may in some instances be over coated with a concrete weight coating for mechanical and scour protection and/or buoyancy control. Pipe used for HDD waterway crossings may also be coated with an additional abrasion resistant coating e.g. polypropylene. The external coating of the pipeline has the same design life of 50 years as the pipeline. The coated pipeline is also protected from corrosion by a cathodic protection system and will have routine inspection by 'intelligent pigging' to ensure pipeline integrity.

During pipeline construction, the welded joint margins will be field coated using a system compatible with the pre-applied pipeline coating that will also meet the minimum pipeline design life of 50 years. Several field joint coating systems including fusion bonded epoxy and high build liquid epoxy are under consideration

The FBE coating used for the pipeline will be solvent free and cured before the pipeline is buried. Epoxy coatings are generally considered inert and risks associated with leached material into the aquatic environment are considered low.

6.2.4 Hydrotesting

Hydrostatic testing (hydrotesting) involves pressure testing pipelines with water to demonstrate pipeline strength and leak tightness. Hydrotesting is undertaken upon completion of construction,

normally after trench backfill, and prior to pipeline commissioning. Comments on the Draft EIS centred on clarification of the procedures for hydrotesting the pipeline, chemical composition of the resultant water and methods and risks of disposing the water.

Implementation

The current planning identifies 11 mainline hydrotest sections of approximately 55 km per section. It should be noted however that with the verification of test section criteria during detailed design and refinement of construction planning schedules, there is potential that the number and length of hydrotest sections may change. The hydrostatic test plan will be developed prior to construction and will identify test section locations and lengths based on detailed alignment data and test requirements including strength and leak test criteria. In addition to the mainline test sections, each HDD pipe string will be pre-hydrotested at the river location to ensure the pipe string to be pulled under the river bed has the desired integrity.

The anticipated duration of all hydrotesting operations will be in the order of 3.5 months for the one year build option and total 5.5 months (over two seasons) for the two year build option. The mainline test sections are buried at the time of testing with the reinstatements completed. All hydrotesting will be completed in sequence approximately two to four weeks after reinstatement completion for each individual test section. The duration of each test section is variable but is expected to take between five to ten days.

The only section of the trench remaining open will be at the tie-in location between two mainline test sections – this will be approximately 75 m in length to enable flexibility for the pipeline tie-ins. Immediately after the tie-in point has been completed, the area will be backfilled and reinstated. Completion of the tie-in is usually within seven days and is dependent on progress of the mainline pipe installation.

The hydrotesting of a mainline section consists of the following operations:

- Cleaning by passing pipeline inspection gauges (pig) to ensure that the pipeline is free of any debris, sands, and solids.
- Passing a gauging plate through the pipeline. A gauging plate is an aluminium plate attached to the pig and is 95% of the diameter of the pipe interior. This gauge is passed to ensure that during the lowering and pipe backfilling operations the pipe has not been damaged in any way.
- The mainline test section is then filled with water by using filling pigs and then the filling completed by a pumping system to ensure that no air remains with the test section.
- The mainline test section is then pressurised to the desired test pressure. The test is held for a 24 hour period during which time the test pressure is controlled on an hourly basis to observe any loss of pressure which identifies a leak along the mainline test section. Temperature is measured at key locations along the pipeline so that the test pressure changes with temperature can be matched to the change in temperature of the pipeline.
- Once the 24 hour test has been successfully achieved, the test water is then removed with dewatering pigs with water either being discharged into a ‘turkey’s nest’ water storage pond or directly into the next mainline test section.
- To remove any areas of trapped water, a series of foam pigs is propelled through the pipeline with compressed air until such time the pipeline is free of any water or moisture. The pipeline is then dried with dry air.

- The mainline test section is now ready to be tied into the next mainline section that has been completed.

A detailed methodology for hydrostatic testing will be included in the Hydrostatic Test Plan which will be completed prior to commencement of construction.

Chemical composition of used hydrotest water

The contaminant levels contained in typical hydrotest disposal water are generally considered non-toxic. The chemical species listed in Table 7-7 of the Draft EIS (*Limits for the application of hydrostatic test water to land [CMIT, 2005]*, including As, Cd, Cr (VI) and Pb) are general limits applied to land disposal of water and are not associated with *added* chemicals to hydrotest water. In lined pipes, the amount, if any, of each chemical species listed in Table 7-7 of the Draft EIS found in released hydrotest water, will be primarily attributed to the source water quality and not chemical additives to the hydrotest water.

The quality of disposal water from the hydrostatic testing will be affected by the following:

- Quality of the source water.
- Reactions between internal pipe and test water (mostly eliminated through use of lined pipe).
- Chemicals added to the test water, as required.

The following outlines an overview of the proposed hydrostatic testing approach. Wherever possible, it is proposed that chemicals *not* be added to the test water.

Water used for the hydrotest will be sourced from local surface water or groundwater and therefore the water quality will vary at each location. The source water quality, together with internal pipe material composition and anticipated hydrotest duration, would determine the chemicals, if any, required to be added to the hydrotest water.

The internal epoxy coating lining proposed for the KGGP pipeline avoids the potential for mill scale breakdown and residue formation as can be experienced for unlined pipes. CSIRO (2005) analysed the disposal water from ten hydrostatic pressure tests on new steel pipelines conducted in Australia for metal contaminants, salts, nutrients and other species which might have a detrimental environmental impact upon disposal. Source waters prior to and after the incorporation of additives were also analysed. The following conclusions were made:

- Source water is the main source of nutrients (NOX, NH4+ and P), metals such as Ar, Cd, Co, Mn, I, inorganic salts, sand/soil and ionic species such as SO42-, Cl, Ca, Mg.
- Fe, Mn and Zn were the most abundant elements detected. These metal residues enter the water during hydrostatic testing primarily through breakdown of mill scale.
- Residues from oxygen scavengers contributed to an increase in salts of sulphur, ammonia or sodium, depending on the formulation of the scavenger;
- Disposal water was free of oil and grease. This was expected as these were new pipelines.
- Pre–cleaning of the pipe removed mill scale and sediment in the pipe, reducing the amount of debris collected during disposal.

CSIRO (2005) went on to indicate that research has shown that internal lining of pipelines avoids mill scale breakdown, residue formation and most other pipe related contamination. This helps reduce suspended solids and simplifies turbidity control.

In addition, the use of a lined pipe together with minimisation of water retention in a pipe test section reduces and/ or eliminates the need for use of chemicals such as oxygen scavengers and biocides in the test water.

If the quality of source water is found to be of unsuitable quality, however, the addition of chemicals may be unavoidable. Hydrostatic test water additives required to minimise the risk of corrosion damage to the pipeline fall into two main groups:

- **Oxygen scavengers** - chemicals that reduce the amount of oxygen available for corrosion of the pipe metal in water.
- **Biocides (or bactericides)** - chemicals that prevent the formation and growth of micro-organisms in water.

The addition of biocides to hydrotest water is not expected to be required for the KGGP. The internal pipe lining provides physical protection from bacterial corrosion. Biocides would only be added to hydrostatic test water when microbial levels in source water are elevated and damage to the pipe is a high probability. The hydrostatic test plan for the project is being developed to avoid the use of biocides; however, in the unlikely event that they are required, the plan will include specifications for the selection of biocides, taking into account treatment and disposal options. Storage and evaporation would be the preferred method of disposal and no release of disposal waters containing biocides will be made to land or waterways.

Additional detail: hydrotest water disposal arrangements

Areas for disposal of hydrotest water will be identified with a preference to utilising stable (rocky) vegetated sites within the 100 m pipeline corridor wherever feasible and preferably within the ROW. Alternatively, where a suitable disposal area within the pipeline corridor cannot be identified, then sites of similar characteristics in areas near to the pipeline corridor would be used.

The site Manager HSE (or their delegate) will be responsible for selecting the suitable location and timing for release of hydrotest water for disposal in consultation with the land-owner and in accordance with the approved Environmental Management Plan.

Disposal locations shall be confirmed to ensure:

- The receiving ground is not prone to erosion.
- The water flow does not lead into or adjacent to an existing watercourse.
- The water does not soak into drainage areas for watercourses or bores used for domestic water supply.
- The water is not discharged onto a site with significant habitat value for flora or fauna.
- All containment and erosion control measures are in place.

Design and location of water storage ponds

In the unlikely event that it has been necessary to add chemicals to hydrotest water, the preference (subject to site specific risk assessment) would be to store and dispose of the water in dedicated water storage ponds.

The water used in hydrostatic testing will be tested for suitability before being used and, should oxygen scavengers be determined to be required (as outlined above), the source water will be dosed with the minimum amount required to prevent internal pipeline corrosion. This oxygen scavenger is neutralised upon discharge into the atmosphere at contact with oxygen. The hydrotest water may also be used to suppress dust on access tracks.

The size of the water storage ponds would be a function of the length of the hydrotest sections and whether water will be transferred from one test section to the next test section. The decision on this would be subject to the availability of water supplies. If required (see above), the ponds are currently proposed to be approximately 60 m X 60 m X 1 m deep. The banks would be formed from excavated material with a batter of 1½:1.

The hydrotest water ponds will be suitably lined with either clay (where locally available) or impermeable membrane. Where practicable, test water shall be used for multiple test sections, thus minimising the quantity of hydrotest water for disposal, number and size of water ponds required and reducing the overall water requirements for the project.

The locations of the water storage ponds will be developed as part of the Hydrostatic Test Plan for the project and are expected to be contained within the 100 m pipeline corridor, construction camp bounds or other approved construction areas. Location will also be subject to the Site Selection Protocol (Draft EIS, Appendix U) to ensure avoidance of sensitive habitats or environmental values. The ponds would be sited so that they do not capture overland flow and to avoid the potential damage by overland flow or local flooding.

Where full evaporation of hydrotest water (subject to addition of chemicals during the testing process) is not possible due to the quantities and timing in relation to weather conditions, disposal to land is proposed. Water quality is tested prior to any land disposal and treatment methods applied, if required, to ensure released disposal waters meet the standards set out in Table 7-7 of the Draft EIS. General water treatment methods may include:

- Retention/storage of water to allow settlement of suspended solids.
- Addition of anti-flocculants if required to further reduce water turbidity.
- Use of water diffusers (e.g. spray bars or nozzles), to aerate water and assist removal of remaining oxygen scavenger.

The water storage ponds would be temporary. Rehabilitation of the hydrotest water ponds will be undertaken at the completion of the construction phase and will include removal of any contaminated sediment and liner for disposal in licenced landfill facility, re-contouring of the soil to its pre-existing form and rehabilitation of the area in accordance with the Provisional Rehabilitation Management Plan (Draft EIS, Appendix O) and approved Construction Environmental Management Plan.

Potential risks to human health

Any unreacted scavenger that remains after the hydrostatic test can be neutralised by promoting contact of the disposal water with air, e.g. via aeration or spraying.

In the unlikely event that chemicals are required to be added to hydrotest water, safety to human health will be ensured by:

- Fencing of the ponds to ensure no unauthorised access.
- Lining of the ponds to avoid leaching into groundwater.
- Removal and disposal of any contaminated sediment from the ponds at a licensed landfill facility.

In the unlikely event that biocides are required to be added to hydrotest water, a risk assessment would be undertaken beforehand to ensure that chemical used has low toxicity and a corresponding appropriate management and disposal strategy.

Potential risks to wildlife

The pond site(s) would be surrounded by a fence designed to prevent access by livestock, and larger animals and in order to prevent damage to the liner. An additional barrier will be fixed to the bottom of the fence to discourage use by smaller wildlife and in the unlikely event that a smaller animal enters and falls into the water, the batter slope is considered sufficient for most animals to be able to walk or climb out of the water.

To minimise the potential use of ponds (if required) by Gouldian Finches, the ponds would not be located within identified breeding (and coincident dry season foraging) habitat for the Gouldian Finch or outside of breeding (and coincident dry season foraging) habitat, within 4 km of identified patches of (> 1 ha) of salmon gums.

In the unlikely event that biocides are required to be used in the hydrotest water, a risk assessment will be undertaken beforehand to ensure that the chemical used has low mammalian and bird toxicity, at the anticipated concentrations. Risks of mortality to mammals and birds from drinking used hydrotest water would therefore be expected to be low.

6.2.5 Water resources and extraction for project needs

The Draft EIS presented information on anticipated water needs for the KGGP Project. The water resources of the region proposed to be traversed by the KGGP are not well understood. Accordingly a Water Supply and Adaptive Management Strategy was proposed to enable the additional information on water resources obtained during the design phase and any residual uncertainties to be accounted for when securing water for the project (the water supply strategy favouring surface water extraction initially, supplemented by groundwater resources if necessary) and in a manner that ensured water extraction would not exceed sustainable yields.

The total water needs of the project are not high, and water extraction would be temporary and of a short duration. Nevertheless, the Draft EIS proposed measures to ensure that the intended extraction would not impact the local environment, cultural values or community water needs in the region. For example, water would not be extracted from isolated perennial pools that could provide important resources and habitat for the Gouldian Finch or Freshwater Sawfish.

Comment on the Draft EIS sought:

- Additional detail or clarification on the water resource information presented in the Draft EIS.
- Additional water resource information for watercourses not addressed in the Draft EIS.
- More detail on how the Water Supply and Adaptive Management Strategy would be implemented for measuring and monitoring stream flow and detecting excessive extraction.
- Confirmation on bore construction if required and clarification of the processes for landholder consultation.
- Clarification on water demand for the project and how the intended locations of extraction relate to sites proposed for HDD crossing.

Surface water information and assessment

The data presented in Table 7-1 of the Draft EIS has been extracted from the former Department of Natural Resources, Environment, the Arts and Sport (NRETAS) stream flow database. The database was updated following the restructure of the NRETAS and is now maintained by the Department of Land Resource Management (DLRM). The network of stream gauging stations operated by DLRM is relatively sparse. All available data has been extracted from those gauges located on watercourses proposed to be crossed by the KGGP.

The ‘Max. Flow’ data is the maximum recorded flow extracted from the monthly summary flow data. It is noted that the updated streamflow database provides maximum recorded flows for some gauges that are not available from the monthly summary data due to the database quality control procedures for incomplete data sets. Table 7-1 of the Draft EIS has been updated to include the revised maximum flows (Table 6-4).

The gauge sites operated by the Northern Territory Government are generally located some distance away from the proposed crossing sites for the pipeline. Pacific Aluminium has commissioned flood studies to estimate design flood peak flows for watercourse crossing sites (HDD and open trench crossings). The flood studies will target catchment areas greater than 20km^2 and will assist in buoyancy control design and scour estimation.

The maximum flows correspond to flood events and are therefore significantly greater than bankfull flows. There is currently insufficient data available to enable bankfull flows to be estimated. This will be addressed following the ground survey of the waterway crossing sites and flood studies to be completed during the design phase.

The stream flow of all waterways proposed for water extraction will be measured in the weeks prior to the proposed extraction to determine the existing conditions and suitability for extraction at that time. Stream flow will be measured by area-velocity method as described below.

The discharge (Q) from creeks, small streams and rivers can be determined using the Area-Velocity Method, where the cross section area (A) is known and the mean velocity of the stream flow V determined and the discharge Q is given by:

$$Q=AV$$

where Q is the discharge expressed in cubic metres per second (m^3/s)

A is the stream cross section area (m^2)

V is the mean velocity of stream flow (m/s)

Suitable locations for temporary streamflow monitoring would be selected by site inspection. Sites would be relatively straight, regular and stable with easy access for monitoring of water level.

Important considerations when locating a stream gauging station include the hydrologic characteristics of the stream channel, the stability of the natural stream controls at all stages of flow, all-weather site access, elevation above maximum flood level, power source, and remote communication options. The mathematical relationship between stream stage and discharge at a stream gauging station is known as a rating curve. The stability of natural stream controls is important when establishing a rating curve. Rock bars are considered stable controls whereas sand and gravel beds are less stable and rating curves will often change over time. At gauging stations with unstable bed controls, the low flow component of the curve needs to be regularly remeasured.

The stream line adjacent to the selected cross section should be straight and of uniform slope, free from obstructions and allowing a regular non-turbulent flow. The stream cross-section shape can be determined by level and staff, tacheometry (Total Station), soundings from a cross-wire or similar means and the cross section area ‘A’ calculated by Simpson's Rule or the Trapezoidal Rule. The mean velocity ‘V’ of the stream flow at the cross section can be determined by timed observation of floats or by current meters or other practical methods.

‘Excessive’ extraction has been defined as exceeding 20% of natural flow at site.

The cross-sections of waterways will be surveyed and a water level gauge board or an automatic recorder will be installed. Flow velocities will be measured or estimated using a float. Stream flows will be calculated as outlined above and extraction volumes calculated using pump capacity and operating times.

The proposed water extraction points, except the extraction point on Beswick Creek, are located adjacent to the proposed HDD crossings (Figure 6-9). (It is not proposed to cross Beswick Creek using HDD.)

Table 6-4: Updated stream flow data summary

GAUGE ID	STREAM	PERIOD OF RECORD	MEAN ANNUAL DISCHARGE (ML/YEAR)	AREA (KM^2)	RUNOFF (MM/YEAR)	MAX. FLOW (M^3/S)	MIN. FLOW (M^3/S)
G8140086	King River	1/2/64 - date	42930	484	89	326	0
G8250002	Goyder River	1/9/67 – 1/9/02	788,940	5,440	136	1,510	1.9
G8260053	Latram River	1/11/63 – 1/11/85	25,230	85	293	186	0
G8260219	Giddy River	1/9/71 – 1/11/86	44,150	111	552	617	0
G9030003	Wilton River	1/9/67 – 1/6/78	505,000	4,480	112	2,543	0
G9030088/9	Waterhouse River	1/12/60 – date	239,760	3,110	73	2,461	0

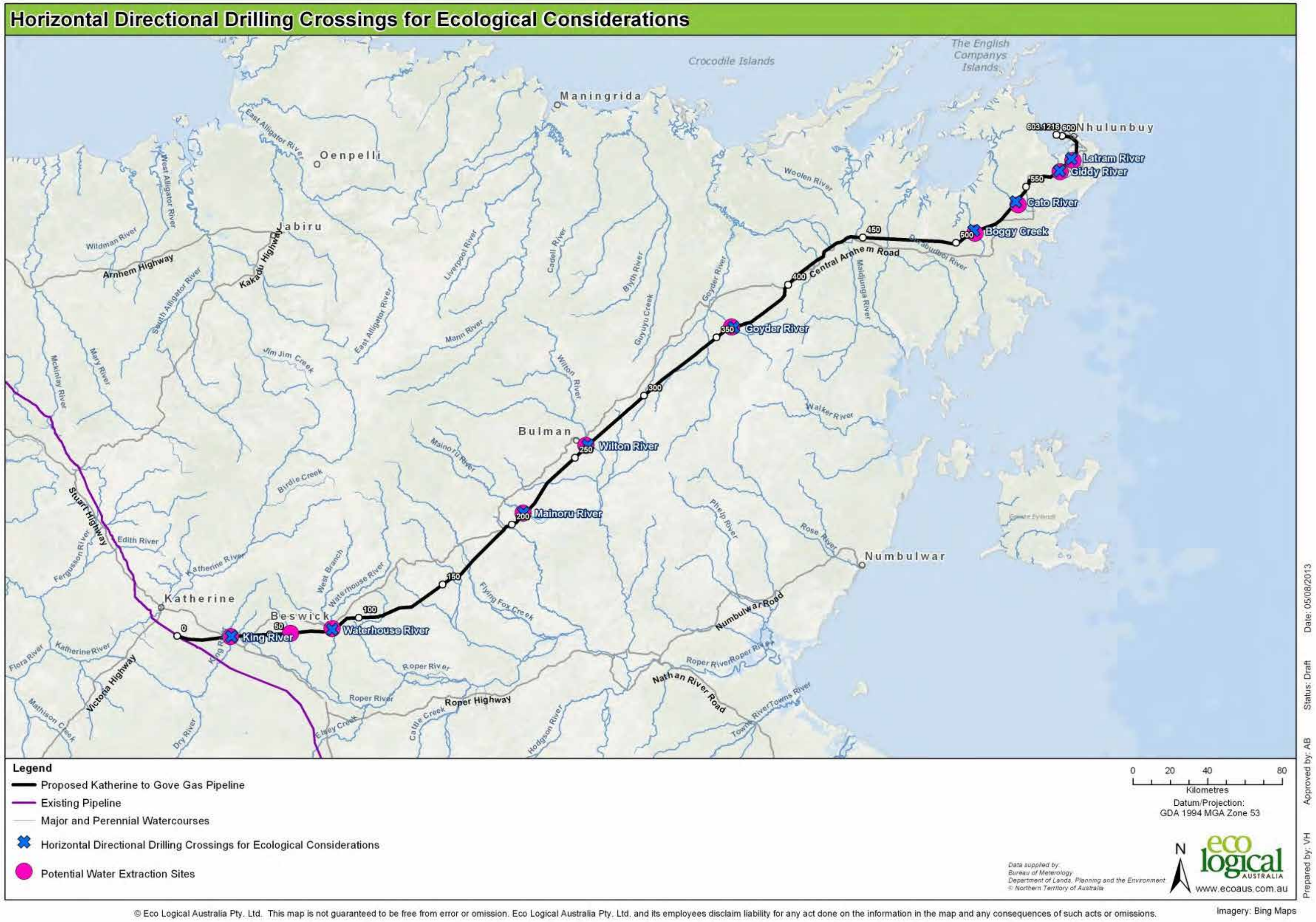


Figure 6-9: Possible sites of surface water extraction and HDD crossing locations

Groundwater information and assessment

Assessment and field verification of existing groundwater bores would be the primary approach to evaluating the capacity and sustainability of potential water extraction from groundwater sources for construction activity (noting, as per the Water Supply and Adaptive Management Strategy, that groundwater would be utilised in the event that surface water sources were unavailable or extraction required to cease).

The results of the field verification of existing groundwater bores are expected at the end of 2013. Should the results indicate further investigation is required to meet the project's water requirements, additional groundwater studies will be undertaken, including investigation of new groundwater bore(s) as required. Additional groundwater studies for new bores (if required) would assess available water, rates of recharge, and potential impact of the bore(s) on the surrounding environment, including assessment of the potential for aquifer cross-contamination. Further field investigations, testing and verification may be required, as determined through the additional groundwater studies.

Water extraction for project needs

The field investigations outlined above will be undertaken during the design phase, as land access and landholder consent allow. It is, however, acknowledged that as a result of the currently limited field and water resource data and the seasonal variability influencing actual surface flow conditions at the time of construction, there remains some uncertainty in demonstrating the outcomes of intended water extraction in relation to sustainable yields of the affected water resources.

To manage this uncertainty, Pacific Aluminium has developed a preliminary Water Supply and Adaptive Management Strategy for the supply of water for construction activities (section 7 of the Draft EIS). The strategy indicated that the preferred water supply would be from surface water resources;, however, given that construction is proposed predominantly during the dry season, when surface water resources are highly variable, alternative groundwater and municipal water supplies would also be considered. Key information on surface and groundwater resources will be collected (as per above) before construction, to guide decision-making on the identification of suitable water extraction locations, and during construction, to guide the shift from the preferred surface water extraction to (if necessary) ground water extraction or municipal water sources.

Extraction of water will be undertaken in a manner that meets the requirements of extraction licences and government regulatory conditions. Flow monitoring will be conducted during the construction period, with hourly records kept, to ensure impacts are mitigated in line with the current NT guideline of restricting extraction to up to 20% of flow.

Where insufficient surface water flows exist, alternative water sources would be sought in line with the Water Supply and Adaptive Management Strategy. Any use of existing groundwater bore(s) or new proposed bore(s) will be in consultation and agreement with the local landowners. Any new bores will be constructed by a registered NT driller, following suitable assessment through additional groundwater studies. In circumstances where the use of existing or newly constructed bores is necessary to meet project water needs, the limits on extraction imposed through conditions of the water extraction licence (issued pursuant to the *Water Act*) will be complied with.

Pacific Aluminium commits to submitting a report outlining the water expectations for the project prior to commencing. The report will be submitted to the NT EPA and NT Department of Land Resources Management. Ongoing sampling and measurement of water sources during construction will measure

the usage to ensure levels of water extraction are sustainable. Reporting will be consistent with the requirements of water extraction licences issued pursuant to the *Water Act*.

6.2.6 Access tracks

Access tracks are required during the construction phase to move equipment and the workforce from the Central Arnhem Road to the ROW where construction activity would occur. As indicated in section 3.6 of this EIS Supplement, up to 152 km of new access track and up to 230 km of existing access track (requiring varying degrees of upgrade to meet project specifications) would be required during the construction phase. Options for reducing access track requirements through use of temporary bridges at watercourses is currently under investigation (see section 3.6). Respondents to the Draft EIS raised concerns about aspects of the design of access tracks (particularly in relation to watercourse crossings), clarification of how the tracks would be utilised, weed encroachment, capacity for tracks to facilitate unauthorised access and additional detail on how the tracks would be decommissioned and rehabilitated. These issues are addressed below.

The proposed KGGP pipeline would run parallel to the Central Arnhem Road for a distance of approximately 550 km. The distance from the Central Arnhem Road to the pipeline ROW varies between one to twenty kilometres. The Central Arnhem Road is the primary transportation route for the project. Access from this road to the ROW during construction will be by the use of both existing and new access tracks. Upon completion of construction, the majority of access tracks will be rehabilitated (through natural and/or assisted revegetation), with the exception of those required to access permanent pipeline facilities (scraper stations, MLVs, anode beds, compressor station), or those requested to remain by the landowners.

Access tracks will be used by construction vehicles and machinery including pipe haulage road trains, water and fuel bowsers, low loaders, drill rigs, construction equipment, mobile cranes, dump truck, buses and 4x4 vehicles. The maximum length of vehicle is expected to be 40 m; passing areas will be provided where suitable; and turning bays will be located on the ROW.

During recent non-intrusive field investigations (July 2013) the use of existing and potential new access tracks was discussed with members of NLC and Aboriginal traditional owners. These discussions and future engagement with landholders will assist in refining access track siting and design. The final location of proposed access tracks is subject to detailed design and will be guided by the findings of the Aboriginal Areas Protection Authority survey and ongoing discussion with NLC/Aboriginal traditional owners, ecological survey and ground condition survey.

Access tracks will, where practicable, avoid crossing waterways. Where temporary access tracks are required to cross waterways during the construction phase, they will be designed to facilitate fish passage and minimise environmental impact through guidance from the Australian Pipeline Industry Association (APIA) Code of Environmental Practice (May 2013). Temporary installations will be removed upon completion of construction and at the time of watercourse reinstatement.

The locations and techniques for crossing of watercourses by access tracks are subject to detailed engineering design and will be determined based on existing site conditions at the time of crossing (ground conditions, bank stability, water flow, existing vegetation). Temporary crossings will typically consist of installation of a series of flume pipes parallel to direction of water flow (to facilitate water and fish passage) overlayed with bog mats or geotextile fabric. As per construction along the ROW, consideration would also be given to the use of temporary bridges to minimise avoid in-stream disturbance resulting from the crossing of watercourses by access tracks.

In the event of permanent installations (culverts) being required on access roads to the permanent facilities (e.g. mainline valves, scraper stations, anode beds), these will be designed to minimise environmental impacts by taking into account existing ground conditions, topography, vegetation and watercourse conditions. Locations and crossing techniques have not been determined but will be subject to engineering design and knowledge gained from future non-intrusive investigations. Permanent installations will be designed where appropriate, to facilitate fish passage and will meet the requirements of any regulatory conditions. In the absence of Northern Territory guidelines for design of waterway crossings that allow passage of fish, reference will be made to the Queensland Government waterway barrier works guidelines (DAFF, 2013) as well as Kapitzke (2010) and Fairfull and Witheridge (2003).

Existing access tracks have been identified from aerial imagery (Google Earth). The majority of these tracks are disused 4x4 vehicle tracks and will require upgrading to cater for the construction vehicles. This will involve extending the width of the track by approximately three to four metres using a root rake; importing gravel; and resurfacing any areas that are unstable for subsequent use by project vehicles and equipment. Turning bays along the access tracks would not be required; however, it is envisaged that passing areas will be installed where deemed appropriate.

Where existing access tracks are not available for use, new access tracks will be required to facilitate efficient access to the ROW from the Central Arnhem Road. In some instances these are anticipated to be as long as 20 km but on average are anticipated to be in the order of five kilometres each.

New access tracks would be constructed to approximately five to seven metres wide and will require clearance of vegetation up to 10 m wide.

Imported gravel would be placed, graded and compacted to created access for construction vehicles and equipment, namely pipe haulage road trains, water and fuel bowsers, low loaders, construction equipment both tracked and rubber tyred, mobile cranes, dump trucks, buses and 4x4 vehicles.

A review of proposed new access tracks will be undertaken with the Aboriginal traditional owners / landowners and will be guided by the findings of the Aboriginal Areas Protection Authority survey. Upon confirmation of the suitability of these locations, the Site Selection Protocol (Appendix U of Draft EIS) will be implemented. The protocol provides a robust framework for the management of each component of the development in a manner that minimises its potential impact on the environment, through avoidance of sensitive soils and habitats and important cultural values. Spatially, the siting of access tracks is flexible, enabling avoidance to be achieved. Implementation of the Site Selection Protocol would be supported by the preparation of detailed vegetation mapping, consistent with the methods described in section 4.1 of this EIS Supplement. Pacific Aluminium has committed to preparing a Final Access Track and Construction Camp Summary Report to the NT Government and DSEWPaC, demonstrating how the access tracks/roads were designed and constructed to avoid and mitigate impacts. This commitment was made in the Draft EIS and has been confirmed and expanded upon in this EIS Supplement (see section 3.6).

Reinstatement and rehabilitation of the construction access tracks will be undertaken upon completion of construction of the pipeline, with the exception of those permanent tracks to remain for the operational life of the pipeline facilities, or if requested to remain by landholder. Temporary access tracks will be rehabilitated when construction in that section of the pipeline is completed.

Reinstatement and rehabilitation of access tracks will be as guided by the final Rehabilitation Plan and typically involves:

- Rip and rake of imported material.
- Replacement of topsoil (previously stockpiled beside the access track).
- Seeding (if appropriate to facilitate rehabilitation).
- Weed control.

The finalised provisions of the Weed Management Plan and the Rehabilitation Plan (provisional plans provided in the Draft EIS, Appendix O) would also apply.

Rehabilitation of the ‘permanent’ facility access tracks will be detailed in the decommissioning plan, as discussion in section 3.9 of the EIS Supplement.

6.2.7 Weed management

Comments on the Draft EIS pertaining to weeds related primarily to:

- The extent of baseline information about existing weed infestations along the pipeline route and the recommended inclusion of Grader Grass (*Themeda quadrivalvis*) as a target species.
- The level of risk pertaining to the potential for the introduction of new weeds and spread of existing weeds as a result of pipeline construction and operation, particularly in areas considered to be currently: weed free; subject to minimal existing environmental impact; inaccessible and/or of conservation significance.
- The level of detail and confidence in the process and goals provided in the Provisional Weed Environment Management Plan, particularly regarding hygiene and prevention of weed seed spread; linkages with existing statutory weed management plans; and the timeframe over which weed monitoring and control operations will be undertaken.

Pacific Aluminium acknowledges that the proposed pipeline has the potential to introduce new weeds and facilitate the spread of existing weeds during all phases of the project. As stated in the Provisional Weed Management Plan (Appendix O, Draft EIS), management objectives would be ‘to prevent the introduction and spread of weed species through project activities; and to minimise the potential impacts of weeds on the surrounding environment.’ These objectives are also reflected in other elements of the Environmental Management Plan, including the Provisional Soil and Landform Management Plan and the Provisional Rehabilitation Management Plan, which collectively address environmental aspects relevant to weed management.

Further development of the weed management measures (consistent with the Provisional Weed Management Plan) will be undertaken in close consultation with relevant stakeholders and authorities, such as the DLRM, NLC, Dhimurru Aboriginal Corporation, Laynhapuy Homelands Association Incorporated, and other relevant land managers (including landholders, pastoralists and Landcare and ranger groups). Pacific Aluminum recognises that effective weed management is achieved only through integrated and collaborative effort and envisages close cooperation with these groups. The final Weed Management Plan will form part of the Construction and Operational EMPs.

More detailed weed management planning will incorporate the following elements:

- The collection of additional baseline weed information on the incidence and extent of weeds within and immediately surrounding the project area, including access tracks and roads, with particular emphasis on target species.

- The development and implementation of a risk assessment approach identifying key weed management areas and outlining for each of those areas:
  - Specific weed management goals in the short, medium and longer term that align with existing statutory management strategies and plans;
  - Levels of monitoring and control in key weed management areas, including the range of most appropriate control methods to be used and the length of time over which monitoring and control measures are required; and
  - The range of preventative measures to be used in each weed-affected area, including the location of vehicle wash/blow down facilities.
- Accountabilities and responsibilities for prevention of spreading weeds and management of weeds in the project area.

Risk assessment, baseline weed information and weed management strategies (including preventative measures) are discussed in more detail below.

Baseline weed information

The need for a more comprehensive baseline weed dataset is acknowledged, and preliminary reconnaissance survey work has already commenced. Weed observations were also made during the flora survey to the north of the Mitchell Ranges in 2013 (see section 4.2 of this EIS Supplement).

Consistent with Pacific Aluminum's commitment to collaborate with DLRM, this data has been shared with the Department so that a common understanding and agreed approach to weed management can be developed. More detailed weed mapping will be undertaken, which will aggregate the most recent data available from DLRM, the results of reconnaissance weeds survey, and the collection of more detailed weed incidence data to be collected prior to construction. Detailed weed data will be collected and provided to DLRM in accordance with 'Guidelines for weed data collection in the Northern Territory, Version 3.0' (NRETAS 2010), which are based on national guidelines by McNaught *et al*. 2006. Identified weed occurrences in the project area will be mapped and controls will focus on project activities causing disturbance, within these mapped areas.

As indicated in the Draft EIS, particular emphasis will be placed on selected target species. As a result of comments received on the Draft EIS and a reconnaissance inspection undertaken since preparation of the Draft EIS, Grader Grass will be added as a target species. The inspection undertaken along the Central Arnhem Road and existing access tracks from Katherine to the Goyder River found significant infestations of Grader Grass. Some of these extended for several kilometres along, and up to several hundred metres in, from tracks and roadsides. This weed is recognised as being of significant concern for outcompeting native pastures, decreasing pastoral productivity and increasing fire risk. Target species will therefore include Gamba Grass *(Andropogon gayanus*), Mission Grass (*Pennisetum polystachion*), Prickly Acacia (*Acacia nilotica*) and Grader Grass.

Risk assessment

Pacific Aluminium recognises concerns regarding the assessed level of weed risk in the Draft EIS. As foreshadowed in the Provisional Weed Management Plan, a more detailed assessment of risk would be undertaken to inform appropriate preventative and management actions using the following draft criteria:

- Type of weed, potential to spread and likely impacts.
- Size, density, age and history of infestation.

- Location, topography and proximity to water bodies.
- NT and national classification status: What is the weed's status under the Weeds Management Act; is it a Weed of National Significance; is it one of the five grasses listed under EPBC Act key threatening process?
- Nature of surrounding land use (including conservation, cultural and heritage sites and values).
- Significance to local land managers/landholders.
- Existing weed management in the area.

Additional or modified criteria may be used if identified as appropriate through stakeholder consultations.

Weed management strategies

Based on the outcomes of further weed surveys and more detailed risk assessment, weed management areas and associated strategies, actions and priorities would be identified and would:

- Be consistent with the relevant NT weed management plans and guides (for example, Gamba Grass (currently being updated), Bellyache Bush (*Jatropha gossypifolia*), Grader Grass and Prickly Acacia, etc.).
- Be consistent with relevant national weed management plans (such as those developed for Weeds of National Significance) and the 'Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses' (DSEWPaC 2012). (The latter was developed in response to the key threatening process declared under the EPBC Act 'Ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced Gamba Grass (*Andropogon gayanus*), Para Grass (*Urochloa mutica*), Olive Hymenachne (*Hymenachne amplexicaulis*), Mission Grass (*Pennisetum polystachion*) and annual Mission Grass (*Pennisetum pedicellatum*)' (TSSC undated).
- Provide an adaptive management approach, including periodic review and revision of the weed management plans, strategies and treatment regimes as appropriate.
- Identify appropriate preventative (hygiene) measures and integrated weed treatment strategies for the eradication and control of individual infestations through chemical, physical and fire treatments.
- Identify appropriate parameters for the regularity and time frame over which monitoring and control actions will be implemented over the life of the project.
- Provide guidelines on the timing, type, application and safety procedures of treatments.
- Provide guidelines on the disposal of weeds.

The weed management strategies would take into account existing regional weed management programs and facilitate co-operation with local land managers/landholders such as pastoralists and ranger groups wherever feasible.

The weed management strategies would be initially focused on the construction phase and five year period post construction (operational phase).

Pacific Aluminium recognises that the most effective form of weed management is prevention. A range of preventative measures would be implemented according to levels of assessed risk in identified weed management areas:

- Use of established roads and tracks and avoidance of weed infested sites wherever possible.

- Keeping disturbance and vegetation clearance to a minimum.
- Establishment of wash/blow-down facilities in strategic locations with associated monitoring and control of weeds in these areas. (Specific locations will depend on outcomes of weed surveys and risk assessment).
- Development of general hygiene procedures relating to sourcing of weed-free fill and construction material, wash-down and inspection of vehicles, machinery and tools; regular checks for seeds and mud in/on clothing and boots; and training of staff in hygiene procedures.
- Development of weed disposal procedures.
- Regular weed surveys and monitoring of known infestations.
- Rehabilitation of all disturbed areas in a manner that minimises the risk of weed incursion. This would include measures such as the timely rehabilitation and revegetation of disturbed areas of high to medium risk of weed invasion with a dense cover of native grasses and/or native vegetation. See the Provisional Rehabilitation Management Plan, (Appendix O, Draft EIS) for further details.
- Implementation of specific control measures in and around waterways.
- Working with landholders, the Northern Territory Government and local government agencies to coordinate project controls with landholder weed management efforts and where feasible, identify opportunities for cooperative action on preventative measures.

Additional or modified measures may be considered if identified as appropriate in the course of stakeholder consultations.

6.2.8 Gouldian Finch management

A number of respondents to the Draft EIS commented on the significance of the Gouldian Finches recorded near KP118 and the need for careful management to ensure that potential impacts are minimised. Pacific Aluminium confirms that the management of potential impacts on Gouldian Finches is a critical component of successful KGGP project delivery and has taken specific actions in recent months and made a number of key project commitments including:

- Targeted survey for Gouldian Finches in proximity to the pipeline (conducted in November 2012 and results included in Appendix D of the Draft EIS).
- A survey of breeding habitat and watering resources (conducted in April/May 2013) in the area most likely to support populations (KP0-140). The results of this survey are presented in section 4.5 of this EIS Supplement and have been used to further understand likely residual impacts of vegetation clearance from pipeline construction, expand on mitigation measures and analyse formal environmental offset requirements (see section 5.6 of this EIS Supplement).
- Commitments to additional mitigation including (see section 5.6 for additional detail):
  - Avoiding or minimising disturbance of trees with nesting hollows by re-alignment of the ROW within the pipeline corridor.
  - Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared.
  - Timing the removal of Salmon Gums to avoid disturbance of active nests.
  - Creating artificial nesting habitat in nearby areas using hollows from Salmon Gums that cannot be avoided through the above measures.
- The key Gouldian Finch water resource identified (the waterhole located near KP118) will be avoided. The alignment of the ROW will be shifted to the north of the pipeline corridor,

allowing for a distance of approximately 190 m between pipeline centerline and the waterhole (see section 5.6 of the EIS Supplement).

- A commitment to a monitoring program for Gouldian Finches for 3 years post construction.
- A commitment to a formal environmental offset for the residual impact of the project on breeding (and coincident dry season foraging) habitat for Gouldian Finches, through the implementation of a habitat enhancement/fire management project.
- A commitment to a Risk Assessment and Adaptive Management Strategy for watercourse crossings incorporating the use of HDD and also including the option of delaying other crossings until they are dry to avoid and minimise impacts on dry season water resources for the Gouldian Finch that are associated with drainage lines.

The results of the survey conducted and the detailed planning for the commitments yet to be implemented will be compiled into a detailed Gouldian Finch Management Plan for the project.

6.2.9 Fauna survey techniques

The Draft EIS detailed the results of fauna surveys conducted in the project area during 2003-4 and 2012. Additional fauna surveys were also undertaken in 2013 and the results presented in this EIS Supplement. Large linear developments provide challenges to fauna survey design and techniques due to the distances involved and variety of habitats potentially encountered. Respondents to the Draft EIS requested additional details on the effectiveness of the survey techniques employed.

Effectiveness of remote cameras for terrestrial reptile survey

The Reconyx remote cameras used in the November 2012 terrestrial fauna survey (Appendix D of the Draft EIS) and the survey of the area to the north of the Mitchell Ranges (section 4.4 of this EIS Supplement) are activated when there is both a movement and a temperature differential between the moving object and the background. Reptiles and amphibians are not detected when moving across the field of view at night, because their body temperatures are no different from the background. However, during the day most reptiles maintain their body temperature higher than background temperatures, and can therefore trigger remote cameras. For example, diurnally active skinks (*Cryptoblepharus* sp) and goannas (*Varanus scalaris*) were recorded by remote cameras during the 2012 survey.

In addition to the use of remote cameras, surveys employed a number of other techniques to detect reptiles, including Elliot and funnel traps (2004 and 2013), nocturnal spotlighting, and incidental observations (2004, 2012 and 2013). A total of 32 – 37 reptile species and 7 – 11 amphibian species were recorded using the combined survey techniques during the 2012 and 2013 surveys and this was considered sufficient for the purposes of assessing potential impacts from the project.

Effectiveness of hair tubes

During the 2012 fauna surveys, hair tubes were deployed in conjunction with remote cameras to increase overall survey effort in 10 remote locations (at one location hair tubes were deployed alone because of a perceived risk of loss of cameras).

Although not used as the primary survey technique for mammals in the project area, hair tubes of different diameters and shapes have been found to be effective for a limited range of species (Lindenmayer *et al.* 1999, Mills *et al.* 2002).

Limitations in their use have been demonstrated by Mills *et al.* (2002) and Harris and Nicol (2010) regarding their performance relative to estimates of species diversity and population size derived from signs of activity. Remote cameras have been shown to perform better than hair tubes at detecting bandicoots, brushtail possums, and wallabies (Paull *et al.* 2012). However, Harris and Nicol (2010) also recorded hair from several species in the absence of signs of activity (tracks), indicating their value as a complementary survey technique.

The Commonwealth Government's survey guidelines for Australia's threatened mammals (DSEWPaC 2011) lists hair tubes as "currently used or appropriate" to detect small-, medium- and large-sized ground-dwelling mammals. In species-specific guidelines, hair tubes are recommended for two of the targeted species in the assessment of the KGGP project: Northern Quoll and Northern Brush-tailed Phascogale (Table 6-5).

Table 6-5: EPBC guidelines for hair tube use for target species

MAMMALS	IDENTIFICATION OF HAIR SAMPLE POSSIBLE	HAIR SAMPLING SURVEY RECOMMENDED
Brush-tailed Tree Rat (*Conilurus penicillatus*)	No	No
Golden Bandicoot (*Isoodon auratus auratus*)	Yes	No
Northern Brush-tailed Phascogale (*Phascogale pirata*)	Yes*	Yes (*P. calura*)
Northern Quoll (*Dasyurus hallucatus*)	Yes	Yes (as additional or complementary technique)

* Personal comment from B. Triggs 3/10/12

Although hair tubes have limitations, they remain a cost-effective, efficient and useful method of extending sampling. This type of sampling is particularly important for species that occur at low abundance (including many mammal species that have declined across northern Australia) and in remote locations where intensive trapping is logistically difficult (such as the KGGP corridor).

6.2.10 Trenching and fauna management

A number of comments on the Draft EIS queried the manner in which trenching for the pipeline would occur and how procedures and practices would be implemented in conjunction with construction, in order to minimise the potential for wildlife to fall into and get trapped for prolonged periods in the open trench.

Trenching practices

Pipelines are built in a linear manner and in the shortest possible time period between initial ground disturbance with the 'Clear and Grade' operations and closing the ground with final reinstatements.

The sequence of these pipeline construction operations is:

- Survey and setting out.
- Clear and grade to form the ROW.

- Delivery of pipe to the ROW.
- Bending of the pipe to follow the ground topography or the designed alignment.
- Welding of the pipeline into sections to suit the pipeline centreline and natural obstacles, roads, rivers, creeks, fence lines, areas of inundations, tracks.
- Field joint coating of the pipeline welds.
- Trenching of the pipeline length.
- Lowering of the pipeline sections into the trench including minor rivers, creeks, tracks.
- Backfilling the sections of the lowered and laid pipeline including minor rivers, creeks, tracks.
- Tie-in of the pipeline to the special sections pertaining to direction changes, tracks, roads, minor rivers, creeks, hydrostatic test tie-ins or other special sections.
- Reinstatements, replacing topsoils, replacing fence lines, reinstatements to track, minor river and creek banks, installation of cathodic protection beds.

Estimates under current construction scheduling indicate that the time between initial ground disturbance and reinstatement activities for the KGGP is 12 to 16 working weeks.

Trenching is a critical path activity and as such dictates the speed of the completed works. Trenching operations may be required to work outside the 6:00 am – 6:00 pm working day to achieve the required production rates.

The term 'open trench' defines an excavated trench that is left open before it is refilled after the pipeline has been laid and backfilled. The trench will be opened and closed as quickly as possible and typically would be open for up to three weeks while pipe installation occurs. In favourable ground and weather conditions, the trench will be open for shorter durations, generally in the order of one to two weeks. This applies to the long section of the pipeline, while special short sections such as road crossings, minor rivers, creek crossings and hydrostatic test tie-ins would remain open for a longer period until the tie-ins of these areas are completed.

To achieve the desired average daily installed pipeline production rate of 4.25 km/day, the trenching activities must stay ahead of the welding and lowering in operations. This means that sections of open trench will always exist and will be potentially up to 40 km in length (approximately nine working days of production) in good trenching conditions and up to 60 km in more difficult (rocky) conditions.

The duration of the trench opening at open cut watercourse crossings is dependent on the size and complexity of the crossing and also the flow conditions at the time of construction. It is estimated that the duration of trench opening at the majority of crossings would be approximately one day with the maximum anticipated trench opening period estimated to be in the order of three days.

For the proposed nine HDD locations, trenching would be planned in such a way that the pipeline tie-in point would be available before or after the completion of the HDD crossing. The tie-in between the pipeline and the HDD crossing pipeline requires 'as built' bending of the tie-in piping. Once the tie-in is completed, the backfill of the tie-in may be completed and the clean-up and reinstatement of the area either side of the river would immediately take place. Tie-in sections are estimated to be up to 75 m and may remain open for up to four weeks, dependent on progress of trenching operations.

Susceptibility of wildlife to trench fall: mortality and injury

Fauna that fall into open trenches during pipeline construction may be injured or killed as a result of the fall itself, or suffer stress, dehydration, or predation within the trench prior to their release. A literature review has identified five studies that specifically assess the impact of trench fall on

Australian native fauna and a summary of the conclusions relevant to the KGGP project are provided below. The studies include:

- Ayres and Wallace 1997
- Faulkner 1999
- Woinarski *et al.* 2000
- Doody *et al.* 2003
- Swan and Wilson 2012

The greatest number of species recorded in trenches were reptiles (Table 6-6), primarily small species including skinks, geckos and dragons. The greatest number of individuals collected from trenches varies between studies, with amphibians being most common in more humid weather, and reptiles being more common in drier weather (Swan and Wilson 2012)(Table 6-7).

Smaller animals (<75 g) are more likely to be encountered while clearing trenches. Doody *et al.* (2003), suggest that this may be due to the species' low mobility relative to the distances to escape ramps (which are usually constructed at 200 – 500 m intervals). This is consistent with the Commonwealth survey guidelines for Australia's threatened mammals (DSEWPaC 2011) that note that pitfall traps specifically target small-sized ground-dwelling species and can catch arboreal species such as small possums as they move along the ground. Footprints of larger mammal species on escape ramps or trench surrounds were noted in most surveys as evidence that larger individuals successfully find and use ramps.

Birds are particularly unlikely to be recorded in trenches unless they are fledglings, ground-dwelling species or predatory birds using the trench as a source of prey (Doody *et al.* 2003, Swan and Wilson 2012, Woinarski *et al.* 2000).

The threatened species of most concern in the pipeline corridor (i.e., those with known, likely or possible presence in areas to be directly or potentially indirectly affected by the KGGP) (Table 6-8) comprise seven birds, one invertebrate and one large-sized ground-dwelling mammal. Of these species, only the Northern Quoll (*Dasyurus hallucatus*) and the Eastern Partridge Pigeon (*Geophaps smithii smithii*) are ground-dwelling and likely to be subject to trench fall impacts.

Table 6-6: Composition of native fauna assemblages recorded in previous pipeline trench fall surveys (terrestrial species)

SOURCE	PERCENTAGE OF SPECIES RECORDED			
	REPTILE	MAMMAL	FROG	BIRD
Ayres and Wallace 1997*	61%	21%	13%	5%
Faulkner 1999*	~ 56%	~ 8%	~ 24%	~ 12%
Woinarski *et al.* 2000	73%	23%	2%	2%
Doody *et al.* 2003	47%	19%	20%	14%
Swan and Wilson 2012	62%	15%	20%	3%
Average	**60%**	**17%**	**16%**	**7%**

*data from Swan and Wilson 2012

Table 6-7: Composition of individuals removed during previous pipeline trench fall surveys (native terrestrial species)

SOURCE	PERCENTAGE OF INDIVIDUALS RECORDED			
	REPTILE	MAMMAL	FROG	BIRD
Ayres and Wallace 1997*	64%	30%	5%	1%
Faulkner 1999*	35%	2%	61%	2%
Woinarski *et al*. 2000	53%	43%	3%	1%
Doody *et al*. 2003	41%	3%	56%	<1%
Swan and Wilson 2012	49%	4%	46%	<1%
Average	**48%**	**16%**	**34%**	**1%**

*data from Swan and Wilson 2012

Table 6-8: Threatened species of known, likely or possible presence in areas to directly impacted, or potentially indirectly affected and the likelihood of trench fall for each species

SPECIES	LIKELIHOOD OF TRENCH FALL	EPBC ACT STATUS	TPWC ACT STATUS
Australian Painted Snipe *Rostratula australis*	Highly unlikely	Vulnerable	Vulnerable
Australasian Bittern *Botaurus poiciloptilus*	Highly unlikely	Endangered	NA
Eastern Partridge Pigeon *Geophaps smithii smithii*	Possible (particularly juveniles)	Vulnerable	Vulnerable
Gouldian Finch *Erythrura gouldiae*	Highly unlikely	Endangered migratory	Vulnerable
Gove Crow Butterfly *Euploea alcathoe enastri*	Highly unlikely	Endangered	Near Threatened
Northern Crested Shrike-tit *Falcunculus frontatus whitei*	Highly unlikely	Vulnerable migratory	NA
Northern Masked Owl *Tyto novaehollandiae kimberli*	Highly unlikely	Vulnerable	Vulnerable
Northern Quoll *Dasyurus hallucatus*	Possible although unlikely to be present	Endangered	Critically endangered
Red Goshawk *Erythrotriorchis radiatus*	Highly unlikely	Vulnerable	Vulnerable

Fauna handling procedures

Ongoing monitoring and management of fauna that may enter the open trench is a priority for the project and a key mitigation measure to avoid and minimise injury and mortality to wildlife. Specialist fauna handlers will undertake daily monitoring of all lengths of open trench throughout the project including both the main trench and tie-in sections to ensure timely removal of wildlife, to reduce the risk of injury or mortality. In addition, monitoring will be undertaken immediately prior to the lowering and laying of the pipeline into the trench to ensure that any fauna are removed by the specialised fauna handlers. A detailed fauna handling procedure has been developed and is included at Appendix D.

6.2.11 Social impact assessment

Introduction

The Social Impact Assessment (SIA) for the proposed Katherine to Gove Gas Pipeline (KGGP) Project was undertaken in line with Pacific Aluminium's *Scope of Work for the Social Impact Assessment of the Katherine to Gove Gas Pipeline* and Northern Territory regulatory requirements, specifically the *Environmental Assessment Act (1982).*

The SIA has been structured to align with the Environmental Protection Authority's *Final Guidelines for Preparation of an Environmental Impact Statement for the Katherine to Gove Gas Pipeline* (January 2013).

In conjunction with desktop analysis, consultations specific to the SIA for the KGGP Project were undertaken with a number of stakeholders immediately after the Northern Territory Government confirmed its commitment to supply gas. Additional consultation occurred with potentially affected stakeholders listed in Appendix S of the KGGP Draft EIS, with emphasis on Traditional Owners and communities along the pipeline route. The purpose of these consultations was to verify key issues and impacts, and validate proposed management and mitigation strategies, as addressed in the KGGP SIA and Social Impact Management Plan (SIMP) contained in Appendix M of the KGGP Draft EIS.

The Social Impact Assessment (KGGP Draft EIS, Appendix M, page 13) stated "*At the request of the NLC, SIA-specific consultations have not yet been undertaken with Traditional Owners and communities located along the pipeline route… [which] remains a gap in the current SIA".* Pacific Aluminium confirms these consultations have since been undertaken in conjunction with the KGGP Draft EIS public consultation period, and continued until August 2013 (refer to Supplement Appendix E). Consultations with Traditional Owners were guided by the Northern Land Council as per the *Aboriginal Land Rights (Northern Territory) Act 1976*.

Summary of consultation undertaken for the Draft EIS and Supplement

SIA consultations commenced in February 2013 following indication of the Northern Territory Government's support of the KGGP Project, and concluded in August 2013.

Consultations were undertaken with the Commonwealth and Northern Territory Governments, communities including landowners and Traditional Owners, non-government organisations, businesses, and potentially impacted stakeholders. These consultations informed the stakeholder of the Draft EIS content and project phases, consequences of changed land use, and recorded any concerns or issues raised in relation to social impacts as per the SIA. Due to a large percentage

(71%) of the proposed route being on Aboriginal land, Pacific Aluminium has met regularly with the NLC in relation to the Project.

The SIA consultations placed emphasis on meeting with stakeholders on whom potential impacts were considered of higher significance, to ensure full understanding of their concerns, build relationships and support their knowledge of the KGGP Project. The majority of consultations with communities and Aboriginal traditional owners were attended by NLC representatives, including an NLC translator where required, and KGGP project team members. Visual communication tools were utilised to overcome potential communication barriers.

Appendix E (this Supplement) provides a detailed list of consultations with all stakeholders undertaken since the commencement KGGP Project including SIA specific consultations.

Summary of methods used during consultation and techniques used to communicate the EIS to interested stakeholders

The SIA consultations placed high importance on stakeholders understanding the project phases, with emphasis on land disturbance, construction activities and rehabilitation as well as potential social impacts. Consultation methods and techniques were tailored to match the stakeholders' preferred communication channel.

Consultation with Aboriginal traditional owners was arranged and undertaken in close partnership with the NLC. At the guidance of the NLC, Draft EIS briefings, SIA consultations and KGGP project meetings were attended at times by NLC officers, an NLC interpreter where required, and specialised KGGP project representatives. During these consultations, KGGP project representatives directly addressed technical and safety questions, and the NLC interpreter enabled two-way communication between Aboriginal traditional owners and Pacific Aluminium. These consultations included multiple visual materials displaying project activities (such as picture books and posters to show the construction process and how the pipeline area will appear once it is revegetated), whiteboard and pens to draw concepts where required, examples of environmental survey equipment and a section of steel pipe.

Pastoral landholders were briefed on the Draft EIS and project land access process by KGGP representatives, followed by additional meetings to address any issues or concerns raised within the Draft EIS including social impacts. Email correspondence and telephone conversations were also utilised to continue discussions following these consultations if the landholder was unavailable to meet in person.

Pacific Aluminium organised Draft EIS briefings and SIA consultations with relevant Government agencies, interest groups and industry participants, which were accepted by a number of these stakeholders. Communication via telephone, email, and meetings and interviews continued with these stakeholders following the initial consultations and will continue throughout the life of the Project.

Consultation methods used to communicate the KGGP Draft EIS, project information and potential social impacts included:

- Briefings: consultation with stakeholder to discuss Draft EIS, proposed project activities and associated potential social impacts.
- Meetings: further consultation with stakeholder to discuss aspects of project in detail, including potential social impacts and mitigation strategies.

- Public information sessions: formal presentation about the Draft EIS by environmental consultant, engineering expert and communities' specialist to interested stakeholders. Locations included:
  - Nhulunbuy Walkabout Hotel conference room
  - Nhulunbuy Town Hall
  - Katherine Civic Centre
- Project information stands: informal environment in public location for interested stakeholders to ask a KGGP representative about the Draft EIS, proposed project activities and potential social impacts. Locations included:
  - Katherine and Nhulunbuy Woolworths complex (manned by KGGP representative).
  - Yirrkala community (manned by KGGP representative).
  - Barunga, Beswick, Bulman and Mainoru community stores (manned by KGGP representative and a communities' specialist).
  - Barunga Festival (manned by KGGP representative and an environmental consultant).
  - Garma Festival (manned by KGGP representative and environmental consultant).
- Telephone conversations: utilised if Project representative or stakeholder unable to meet in person or only a brief discussion required.
- Email correspondence: utilised when sending information or brief discussion.

A number of techniques were used to communicate the KGGP Project, Draft EIS and potential social impacts when consulting with all stakeholders. Public information sessions were presented by an environmental consultant, engineering and construction technical expert and communities specialist to address technical questions and issues directly. As previously stated, community information sessions with Traditional Owners were conducted in partnership with the NLC and attended by various Project and NLC representatives, including an interpreter where required. Additional techniques were tailored to communicate effectively with stakeholders to enhance their understanding and knowledge of the Project. Techniques utilised are listed below:

- Visual materials:
  - Hard and soft copy PowerPoint presentations (in plain English for consultation with Traditional Owners)
  - Photo books providing picture examples pipeline construction and rehabilitation process
  - Posters describing construction process, river and road crossings and construction corridor rehabilitation
  - Information sheets (in plain English for consultation with Communities and Traditional Owners) Map of proposed pipeline route and proposed camp locations
  - White board (to provide visual demonstration of equipment or project concepts)
  - Fauna monitoring equipment and images of animals captured during monitoring
  - A section of a steel pipe
  - Project banners with project overview, key facts and map of proposed pipeline route
  - Draft EIS (three volumes and map document) to visually demonstrate extent of project analysis.
- Facebook notifications on Nhulunbuy Notice Board, Nhulunbuy Corporation Limited and Gove Operations' pages.
- Newspaper adverts in Katherine Times, Arafura Times and NT News.

- Posters on central community notice boards.
- Radio adverts on Nhulunbuy community radio (Gove FM), Katherine community radio (8KTR FM) and CAAMA radio (advertised in English and in local language).
- Project website (www.kggpipeline.com.au).
- Toll-free project hotline (1800 PIPELINE).
- Project email address (enquiries@kggpipeline.com.au).

Extent of difficulties associated with languages and literacy

Pacific Aluminium was made aware by the NLC of potential difficulties in relation to effective communication posed by a range of different languages and literacy for communities along the pipeline route, and worked closely in partnership with the NLC to minimise the impact these difficulties had on understanding the Project and potential social impacts. Building a solid understanding of the Project, relevant construction activities, consequences of land use change and potential social impacts was critical during consultations with these stakeholders.

An NLC interpreter participated in information sessions and consultations where recommended by the NLC, so that stakeholders were able to communicate issues in their own language, and so that detailed technical information could be translated appropriately to enable two-way communication between Pacific Aluminium technical experts and Traditional Owners. Pacific Aluminium and NLC met after each consultation to discuss how the meeting was conducted, any issues raised and to ensure stakeholders understood what was discussed.

The extent of difficulties associated with languages and literacy was relatively high at initial briefings due to stakeholders' unfamiliarity with the project concepts including the construction process and associated potential environment, safety and social impacts. However, with the aid of communication techniques discussed previously, these difficulties quickly diminished and allowed for comprehensive discussions during future meetings.

The KGGP Community and Stakeholder Engagement Plan and Community Observation and Feedback Management Procedure are designed to ensure ongoing communication with stakeholders throughout pre-construction, construction and beyond.

At their request, Pacific Aluminium made a copy of the Community and Stakeholder and Engagement Plan for the KGGP Project to the NLC. It is not intended to distribute the plan more widely. The document is considered a 'live' document and will be regularly reviewed and updated. Therefore Pacific Aluminium considers the plan would not be valuable to all stakeholders in circumstances where ongoing weekly dialogue (as is conducted with the NLC) does not occur and the plan may not be appropriately interpreted, in context.

Preliminary outcomes as a result of the consultation

Preliminary outcomes as a result of the Draft EIS and social impact consultations were consistent with outcomes from initial consultations with Traditional Owners and other stakeholders in late 2012 and early 2013 (discussed in detail in the KGGP Draft EIS, Appendix M, SIA and SIMP). Awareness and strong support for the project were communicated to Pacific Aluminium. Potential social impacts raised by stakeholders along the pipeline route were consistent with those recorded during SIA-specific meetings and conversations with stakeholders prior to the release of the KGGP Draft EIS (summarised in KGGP Draft EIS, Appendix M, Table 1-1, page 9).

Social impact management strategies outlined in the SIMP received strong verbal support. Input into further development of mitigation strategies was obtained for a number of impact categories including land and country, infrastructure and services, with emphasis on community safety, in particular traffic and road safety.

During SIA consultations, stakeholders emphasised their interest in participating in the Project through procurement and employment opportunities. Opportunities for local capacity and capability to participate in the Project appear limited within the context of a highly specialised workforce that will most likely need to be brought in for the project; however, further analysis is being undertaken by the KGGP Human Resources and Procurement team. Outcomes of this analysis will contribute to further develop a skills database, local employment plan and procurement plan.

The issues and opportunities raised by stakeholders along the pipeline route were consistent with those raised in the SIA. A summary of stakeholder issues are included in Appendix M of the Draft EIS (Table 1-1, page 9) which can be expanded to include Pastoral land owners' and Traditional Owners' primary issues and sentiment, as provided below in **6-9.**

Table 6-9: Stakeholder issues summary

STAKEHOLDERS	PRIMARY ISSUES AND SENTIMENT
Aboriginal traditional owners	• Overall support for the pipeline and the ongoing future of the refinery. • Environmental impacts, particularly rehabilitation, yellow crazy ants and weeds. • Sacred site protection. • Cultural heritage. • Indigenous employment opportunities. • Safety of gas and a pipeline. • Concerns for community safety around damage to local road surfaces and driver and pedestrian safety. • Concerns that construction workforce may exacerbate existing social issues if located close to communities.
Pastoral land owners	• Overall support for the pipeline and the ongoing future of the refinery. • Environmental impacts, particularly rehabilitation and weeds. • Construction impact on land owner activities such as mustering and animal handling. • Concerns about potential impacts on existing road infrastructure and driver safety. • Safety of pipeline. • Need to manage construction workforce behaviour.

Reach of consultation, outcomes and agreement

All identified stakeholders have been consulted, and additional stakeholders briefed after expressing interest in the Project. Positive support for the Project was expressed by the majority of stakeholders apart from the Environment Centre NT, who advocated for renewable alternative energy sources to power the Gove Refinery. Stakeholders were aware throughout consultations of the various avenues to access information and ongoing communication would continue throughout pre-construction and construction.

To date, all KGGP Project-related land access and land use consultations/negotiations have been undertaken through the NLC as the independent statutory authority under the *Aboriginal Land Rights*

(Northern Territory) Act 1976. Pacific Aluminium will continue to work with the appropriate statutory authorities for all Project-related activities and towards final agreement for use of land.

Pastoral owners have been supportive of access to their land, approving the KGGP project team to undertake environmental and visual construction activities. Each of the seven pastoral owners has indicated the desire to proceed with a land use agreement.

6.3 RESPONSES TO INDIVIDUAL COMMENTS

Responses to individual comments received during the public comment period for the Draft EIS are provided in Appendix A. Where relevant, the responses draw attention to the relevant sections in the Draft EIS and the larger discussion of key issues detailed in section 6.2 of this EIS Supplement.

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PACIFIC ALUMINIUM

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PACIFIC ALUMINIUM

Appendix A

Table of Responses to Submissions

PACIFIC ALUMINIUM

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
1-1 Department of Defence	Defence understands that the King River Compressor Station will generate an exhaust plume. Given the compressor station is located beneath established aircraft flight paths, it is important that the vertical velocity of the plume be modelled by the Civil Aviation Safety Authority (CASA) to confirm it will not pose a safety risk to aircraft operating from RAAF Base Tindal. The EIS should note that the modelling of the plume velocity must be finalised by CASA to ensure the plume velocity satisfies their requirements.	A plume rise assessment of the Compressor Station site will be undertaken in accordance with the Civil Aviation Safety Authority (CASA) Guidelines for Conducting Plume Rise Assessment (refer to CASA Advisory Circular AC139-5(1), 2012). The assessment will be based on a comparison of the predicted plume critical height for the stack against the PANS-OPS (Procedures for Air Navigational Services – Aircraft Operational Surfaces) height above the site. The plume critical height is the height at which the average vertical velocity across the cross-section of the plume is equal to 4.3m/s and must be less than PANS-OPS. There are currently two compressor station locations under consideration, however it is expected that a final compressor location would be determined prior to the modeling being undertaken. The closest compressor station site option (Alternative Alignment) is 14 km from the Tindal RAAF Base boundary. The results of the assessment are expected to be available towards the end of 2013 and will be used to inform the detailed design of the compressor station to ensure CASA requirements are met. The Department of Defence will be advised of the proposed compressor design and location, plume velocity predictions and details of conformance with CASA guideline requirements.
1-2 Department of Defence	There is still a requirement that the RAAF Aeronautical Information Service be advised of all tall structures where the top of the structure is: 30 metres or more above ground level - within 30 kilometres of an aerodrome, or 45 metres or more above ground level elsewhere	During the construction phase, preliminary studies have been undertaken indicating that no telecommunication towers will be erected within 15km of the boundary of the Tindal RAAF Base. Project communication towers, each approximately 30m above ground are anticipated to be located along the Central Arnhem Road at approximately 30km intervals. These towers will be installed pre-construction (currently early 2014) and will be removed upon completion of

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
		construction. Further discussion with Department of Defence and where appropriate notification, will occur once siting is confirmed. No telecommunication towers or masts are required for the operation phase of the KGGP. Initial assessments indicate that the height of the compressor station gas turbine exhaust stack will not exceed 15.5 m.
1-3 Department of Defence	Defence understands that the current Katherine Airport culvert and apron cannot support Boeing 737 sized aircraft without an infrastructure upgrade; therefore the proponent may wish to consider a different aircraft type.	Pacific Aluminium has been in discussions with the Katherine Town Council about the use of the Katherine Airport for the transportation of FIFO employees. The Katherine Town Council (KTC) has confirmed the airport does require an upgrade and is currently investigating partnership opportunities to facilitate the appropriate funds required for the upgrade. KTC is looking at the regional development opportunities for Katherine and one of these is to upgrade the civil component of the Katherine airport. Pacific Aluminium will continue discussions with the Katherine Town Council and does acknowledge smaller aircrafts at a more frequent rate may be required to transport FIFO workers for the KGGP Project. Pacific Aluminium may also investigate at other methods of transport and frequency to understand the most appropriate approach for FIFO employees. This method will also take into account potential social and safety impacts. Pacific Aluminium will continue to work closely with the Katherine Town Council regarding the infrastructure updates and requirements for the civil component of the Katherine Airport and advise Department of Defence accordingly.

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2-1 Amateur Fishermen's Association of the Northern Territory	AFANT supports the option of Horizontal Directional Drilling as the preferred manner of crossing all major watercourses and is concerned that just 9 of the 28 major river crossings are identified as potentially requiring or planned to be directionally drilled. It is essential in AFANT's opinion that all major watercourses that are suitable for HDD are completed in this manner as to minimise the environmental impact on each major watercourse. The issues of concern that still need to be addressed and we believe have not been adequately covered in the EIS is how the proponent will address, identify and monitor any impacts on: • erosion of disturbed/trenched river banks • sedimentation and siltation of the rivers and streams downstream of crossings • how river bed/banks will be armored to protect from erosion • fish and other in-stream biota including threatened species	See 6.2.3 of this EIS Supplement.
2-2 Amateur Fishermen's Association of the Northern Territory	AFANT strongly supports the protection of at least 80% of river and stream flows as well as aquifer discharge along the route during pipeline construction as identified in the EIS. We do not believe that sufficient information has been provided in the EIS on how the proponent will identify, gauge or monitor stream flow and extraction to protect the rivers along the pipeline route from over extraction or depletion during the construction phase.	See section 6.2.5 of this EIS Supplement.

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2-3 Amateur Fishermen's Association of the Northern Territory	The combination of the extreme distance and soil disturbance of this project and the variability of terrain and difficult climatic conditions along the route combined with the high likelihood of extreme weather events over successive wet seasons poses a real risk for significant future erosion events. While AFANT recognises the comments and commitments by the proponent in the EIS on silt traps and sediment control, it is essential that this area is adequately implemented during construction and that the follow-up monitoring and remedial works are conducted at a high standard.	Follow up monitoring and (if required) remedial works have been committed to (see sections 3.4 and 3.5 of the Provisional Soil and Landform Management Plan within Appendix O to the Draft EIS and section 6.2.3 of this EIS Supplement).
2-4 Amateur Fishermen's Association of the Northern Territory	AFANT notes that ongoing operational access after construction will be made via designated access tracks. These access tracks are not included or marked in the detailed maps provided by the proponent. In Chapter 10 dealing with EPBC act threatened species; the issue of causeways that are planned to be constructed across waterways to allow access to the pipeline route during the construction phase is raised. The EIS identifies over 200 waterway crossings along the pipeline route and one can only assume many of these will require vehicle crossings to be constructed. This is not clear in the EIS. AFANT has concerns that for ongoing maintenance to the pipeline, considering the distance from the Central Arnhem road that the pipeline route takes at times, it is highly likely that the access road in some areas will still be required to cross waterways following the pipeline route. River crossing structures and access causeways can cause significant barriers to fish migration and in-stream connectivity. While it states in Chapter 10 of the EIS that causeways should be removed, it does not appear clear in either this or	See sections 3.6 and 6.2.6 of this EIS Supplement.

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	other sections of the EIS on where and how causeways and vehicle access tracks and waterway crossings will be constructed and if they will all be removed. It is important that all structures that have the potential to be a barrier to fish migration are totally removed or constructed in a manner to minimise obstruction.	
3-1 NT Department of Business	The Department considers the Draft EIS provides a solid and sound framework for the project and covers the project's business, employment and economic development issues adequately. We welcome the commitment to develop a local employment plan, a local procurement plan and local and indigenous employment targets. We would, however, recommend that the requirement for an Industry Participation Plan (IPP) is included in the EIS. An IPP is a requirement of the NT's Building Northern Territory Industry Participation Policy for all major NTG assisted private sector projects such as this pipeline proposal.	Pacific Aluminium intends to prepare and submit an Industry Participation Plan for the KGGP Project. The plan will be prepared in consultation with the NT Department of Business and discussions have commenced with Department representatives to progress this matter. Pacific Aluminium has also met with the Industry Capability Network (ICN) NT in both Darwin and Brisbane and has committed to be a part of the network. Pacific Aluminium acknowledges the important role ICN has in the NT and looks forward to working together to maximise benefits to the economy in the NT through participation of local businesses.
3-2 NT Department of Business	In Chapter 3 on project alternatives, brief consideration of other energy sources is included. The EIS could be enhanced by providing more detailed information (particularly for the Liquefied Natural Gas option) on the assessment and relative feasibility of these alternative energy sources. For example, assessment of the use of LNG could include its wider potential to underpin development of a viable domestic LNG industry.	LNG is not considered a viable alternative given it is currently trading at prices similar to that of fuel oil which Gove is attempting to move away from to be viable, and is similarly exposed to fluctuations in global prices as with oil. In addition LNG would require some form of secondary reprocessing at site to be usable which adds further cost.

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3-3 NT Department of Business	In the economic evaluation of the EIS and its coverage of economic benefits (in Appendix A) the proposed project impact on NT taxes and other payments is outlined. The EIS would be enhanced if an estimate of the project's likely impact on Government revenue (via taxes, royalties, etc.) was quantified.	The Katherine to Gove Pipeline will support the continued operations of the refinery and existing revenue streams. There may be a small positive impact on payroll tax during construction.
4-1 NT Department of Health	The Department of Health – Environmental Health Branch requirements are provided in the attached fact sheet 700 'Requirements for Mining and Construction Projects'. Not all sections in the fact sheet are applicable to every project.	The advice and requirements contained in the fact sheet will be addressed during the design phase and finalisation of the Construction Environment Management Plan. Pacific Aluminium is also developing a Health Management Plan as part of the Social Impact Management Plan.
5-1 NT Department of Transport	Generally the EIS has dealt with issues of transport and has highlighted the major impacts on the road network and that appropriate mitigation can be identified. It is expected that Pacific Aluminium would be commencing assessment and negotiation of a possible agreement in line with the EIS in the very near future.	See response to comment 5-5 regarding ongoing discussions with the Department of Transport.
5-2 NT Department of Transport	Use of NTG maintained aerodromes - there has been no description of the proposed use of these aerodromes and their potential impact.	The use of NT Government Aerodromes will be required. The intended use of Aerodromes located at Gapuwiyak, Bulman, Beswick and Barunga will be for both fixed wing aircraft and helicopters to undertake smaller crew rotations, medivac purposes, dignitary visits and delivery of emergency supplies. At Aerodrome locations, minimum quantities of fuels will be stored in drums. Minimum impact from noise and community disturbance is expected since flights will be infrequent and restricted to day light hours with the exception of medical evacuations. Major crew rotations will be from airports located at Gove, Darwin

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		and potentially Tindal.
5-3 NT Department of Transport	The Traffic Impact Assessment will need further definition to fully define the safety and maintenance issues on these roads, this needs to define impact for each of the specific activities, i.e. pipe delivery, compressor delivery , shift changeover, daily travel impact, supply logistics. This would also need to consider the cumulative impact of these activities.	A Traffic Management Plan (TMP) will be prepared and submitted to the Northern Territory Government in February 2014, prior to construction. The TMP will assess and define various aspects including: Work zone traffic management, traffic considerations, Road safety and maintenance, approvals, emergency arrangements, traffic control devices, risk assessment and control measures and specific traffic control plans. Each construction activity has unique traffic requirements and an impact assessment and will be developed, quantified and appropriate consideration included in the TMP. Existing data and reports, such as the Annual Traffic Report produced by the NT government shall be used to assess the impact of the various construction activities on the existing road and access track network for the duration of the project. Complementing the TMP, site observations and assessments will be routinely carried out. Dedicated road maintenance and upgrade crews are expected to ensure all access tracks and roads are suitable for anticipated construction activities, traffic and ensure the safety of all road users on public roads. A Logistics study will be completed as part of the TMP. The logistics study shall assess pipe, equipment and personnel movements in order to most efficiently transport materials and personnel.
5-4 NT Department of	At this stage there is no description of pipe transport arrangements and specific traffic impacts of these activities, i.e. risk assessment and mitigation.	Double trailer road trains are expected to be used to transport the pipes from Darwin and Gove Ports to the various pipe lay downs and ROW. Maximum pipe

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Transport		length will be 18 m triple random length, with approximately 22 pipes loaded per trailer. A total of 1,522 pipe trailer trips (approximately 761 trips for double trailer road trains) are expected from Port to final pipe location on the ROW. Risk assessment and mitigation of the specific transport arrangements for pipe will be addressed through the TMP (see response to comment 5-3 above).
5-5 NT Department of Transport	Pacific Aluminium "contribution" to road upgrades and maintenance is undefined and would need further discussion with the road authorities, although not a specific requirement of an EIS.	Pacific Aluminium has met with members from the Department of Transport to provide a status update of the construction time for the project and potential road use. Due to Departmental structure change within the Government, Pacific Aluminium has also had several discussions at a regional level (Katherine and Nhulunbuy) with the Department of Infrastructure to understand the road conditions and maintenance requirements of the Central Arnhem Road. Based on these discussions and ongoing field studies Pacific Aluminium will develop a road maintenance program for the duration of the project. The Department of Transport will be consulted as part of the development process. KGGP construction activities require well maintained road infrastructure to handle the significant additional traffic and the need to work closely with local authorities throughout the construction phase is recognised.
6-1 Environment Centre NT	The Environment Centre NT has serious concerns about the "locking in" of high carbon emitting technologies through such a large scale infrastructure project. When it is critical that Australia decarbonise its stationary energy sector by 2050 by 80%, this project would make future renewable energy developments in the north less feasible. In particular, we do not believe the draft EIS shows a transparent analysis of	See section 3.5.1 of the Draft EIS. Energy use at the Gove refinery comprises: • 60% for process steam generation. • 35% for calcination. • 5% for electricity generation.

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	alternative renewable energy options. Considering the impact of the project on the future emissions profile of the Northern Territory and impacts on the deployment of renewable energy technologies, it is critical the proponent addresses alternative energy supplies in an EIS. The fact that only 2 pages in such a large detailed EIS is devoted to exploring alternative energy supplies is not acceptable. The proponent makes little reference to its investigations regarding solar thermal, and states that it is not feasible due to high up front capital costs and lack of reliability. If the gas pipeline is to be subsidised by the NT Government, the public have the right to a full technical and economical feasibility study on renewable energy sources for the refinery. A detailed feasibility study would look at the life cycle of costs of different energy options, and discuss potential solutions to implementation barriers. This may include working with government to discuss sharing the upfront capital costs or potential for seeking assistance through the Federal Government's ARENA program. It would also look at the viability of hybrid energy systems to overcome the issues of 24 hour power and steam generation.	The capacity for energy supply to generate steam has therefore been the key technical factor in the evaluation of alternative energy sources for the Gove refinery. Renewable energy sources such as solar photovoltaic, wind, tidal and geothermal were evaluated as unsuitable or unviable sources for steam generation. Energy alternatives that were capable of generating steam were the subject of investigation and analysis over the period 2009-2011 and evaluated (against the base case of continuing to use fuel oil). Four concentrating solar thermal power technologies were reviewed for suitability for replacing fuel oil for stream production (Central Receiver, Compact Linear Fresnel Receiver, Parabolic Trough, and Parabolic Dish). Of these, Parabolic Trough is the most tested. Concentrating solar thermal power technologies were not considered technically viable at the Gove refinery due to the following drawbacks: • Very high upfront capital costs. • Inability for stand-alone plants to provide steam 24 hours a day. Energy storage solutions would be required to provide continuous steam and these systems have not yet been tested at scale. This would further increase capital costs. • Cloudy conditions (particularly during the wet season) would limit solar energy availability and hence limit steam conditions achievable. • Constrained land availability in proximity to the Gove refinery. Large areas of flat land would be required which are only available at distances of greater than 5 km, making it technically impractical to convey the steam back to the refinery.

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		• The systems would be prone to cyclone damage. With respect to 'subsidisation' it should be clarified that the capital and operational costs of the KGGP project will be borne entirely by the proponent. Pacific Aluminium has however, entered into discussions with the Northern Territory Government for the contracting of a quantity of natural gas.
6-2 Environment Centre NT	The KGGP project is estimated to release approximately 50, 800 t CO2e from construction, and a further 248,000 t CO2e from vegetation clearance. This does not include the total greenhouse gas emissions relating to the use of natural gas at the refinery, as these emissions fall outside of the KGGP project and are estimated in Appendix I at 1,715, 475 tonnes of CO2e per year. As a result, the overall greenhouse gas budget is considerable, even when considered in the narrow scope of the KGGP project. The estimate of greenhouse gas emissions from land clearing is conservative as it only accounts for vegetation that falls within the definition of a forest being >2m, >20% canopy cover and >0.25 ha. This avoids having to account for a significant amount of vegetation clearing, despite the significant carbon stocks that would occur in these non-forest vegetation types such as melaleuca forests. If a forest definition was used that is just >2m, >20% canopy cover as is accepted in the national forest inventory, this would be a considerably greater extent of forest that would need to be accounted for. The emissions factors are also based only on aboveground carbon, when the project will involve significant soil carbon and belowground carbon stock disturbances. A study in the tropical savannas of the NT found soil organic carbon in the top 1m of soil accounted for about 74% of total estimates of carbon at a site, so it is likely that emissions from	The comment puts forward the total greenhouse gas emissions at the refinery. These emissions do not form part of the project but nevertheless, the more appropriate measure relates to the greenhouse gas emission reductions at the Gove Refinery, resulting from conversion from fuel oil to natural gas. These emission reductions are considerable and represent a significant co-benefit of the KGGP project. When greenhouse gas emission reductions at the Gove refinery are accounted for, the small annual greenhouse gas emissions arising from operation of the KGGP (approximately 42,000 tonnes CO2-e per annum) would be more than offset by the significant reductions in greenhouse gas emissions at the Gove refinery. The net reduction in greenhouse gas emissions would be approximately 336,000 tonnes CO2-e per annum (see section 12.3 of the Draft EIS). It is presumed that reference in the comment to emissions from land clearing as 'conservative' is suggesting that emissions have been under-estimated. The definition of 'forest' used in the calculations contained within the Draft EIS has been adopted from nationally and internationally established protocols. The Australian Standard 4978 (Quantification, monitoring and reporting of greenhouse gases in forest projects) also requires definition of 'forest' for the purposes of calculating changes in carbon stocks. The standard references two

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	clearing is significantly underestimated). The Australian Government and Environmental Offsets Policy (2012) requires significant residual impacts to be offset, and it does not appear that the proponent has addressed these issues in regards to greenhouse gas emissions or native vegetation. Pacific Aluminium states that small and large scale Photovoltaic systems are technically and economically feasible to supplement the electricity supply of the Nhulunbuy township. As part of the company's social licence to operate, it is important that it commits to exploring and developing such systems for Nhulunbuy. Given that the project will lock in fossil fuel emissions for decades to come, and the extensive clearing of vegetation will lead to further loss of carbon stocks, this at the very least needs to be offset locally. A project to develop wind and solar resources for Nhulunbuy such as that proposed by the Aboriginal Investment Group in 2010 should be explored.	forest definitions: • The Australian National Forest Inventory (ANFI) : minimum of 1.0 hectare, 20% crown cover and 2 m height; and • The National Carbon Accounting System (NCAS): minimum of 0.2 hectare, 20% crown cover and 2 m height. For the purposes of the assessment contained within the Draft EIS, the NCAS definition has been applied, resulting in greater forest coverage and higher calculated carbon emissions, compared with the former definition given in AS4978. The NCAS definition also aligns with Australia's National Greenhouse Accounting practices and the criteria applied with respect to revegetation and Carbon Farming, as detailed in Methodology Determination 2012. The Department of Climate Change and Energy Efficiency has prepared the National Greenhouse Accounts (NGA) Factors in 2012 to assist the wider community to estimate greenhouse gas emissions. The NGA Factors report also defines deforestation (or clearance) as deliberate removal of forest cover (of trees with a potential height of at least two metres and crown cover of at least 20 per cent in patches greater than 0.2 hectare in area). As set out in section 12.3.2 of the Draft EIS - over time, sequestration associated with a return to native woody vegetation over approximately 60% of the pipeline ROW would balance a considerable proportion of greenhouse gas emissions from vegetation clearance. With respect to above-ground and below-ground carbon, both of these aspects are incorporated in the assessment. The NGA Factors Report (2012) points to the NCAS and its Full Carbon Accounting Model (FullCAM) as the

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		recommended methodology in accounting for greenhouse gas emissions with respect to forestry and deforestation. This models the carbon capture of various forest types, including native vegetation, for locations across the Australian mainland. The FullCAM modeling system provides an assessment of the carbon associated with forest trees, and takes into account both above-ground carbon of trees (stems, branches, bark, leaves) as well as below-ground carbon (coarse and fine roots). With respect to soil carbon, considerable work is currently being undertaken by the Soil Carbon Research Program (CSIRO and various universities) in developing a standard for measuring soil carbon across Australia. The outcomes of this project are not yet available. Given the current high level of uncertainty, it is standard practice to exclude soil carbon from Greenhouse Assessment of pipeline infrastructure projects. Pacific Aluminium reaffirms its commitment to explore small and large scale solar photovoltaic systems to supplement the existing electricity supply to Nhulunbuy township when the electricity demands of Nhulunbuy township increases. Contrary to the statement in the comment, the Australian Government's Offsets Policy does not require consideration or offsetting of greenhouse gas emissions. Offsets can be required to address significant residual impacts associated with the Matters of NES subject to assessment. The KGGP project does not have a significant residual impact of flora species comprising Matters of NES and greenhouse gas emissions are not a Matter of NES.
6-3	The construction of the pipeline and associated activities will expose vast areas	Section 16 of the EMP (Appendix O to the Draft EIS) commits to the following

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Environment Centre NT	of largely intact tropical savannas to weed and feral animal invasion. It is critical that this weed invasion be of paramount concern in the environmental management plan. The NT EPA EIS guidelines recognise this threat and require the proponent provide detailed biodiversity management plans with clear and concise methods. It should also provide an assessment of the risks of failure and to identify uncertainties of management efficacy. We do not believe the environmental management plan adequately and clearly states goals that can be monitored and performance measured. There a number of statements within the environmental management plan that allows the proponent to limit its accountability for the occurrence of weed outbreaks and management of native vegetation. For example, in the plan the proponent may ascertain using their judgement whether or not a weed outbreak warrants a threat enough to carry out management activities (p.17-10). Similarly, the statement “manage weeds to the extent practical (p17-5)” does not clearly state goals of preventing weeds from establishing and spreading along both the pipeline and the ancillary roads and activity camps. It is critical that highly invasive weeds such as Gamba grass and grader grass do not gain a foothold in Arnhem land, and the proponent needs to ensure contractors are adequately trained in weed management protocols to prevent this occurring. It is welcome that the proponent acknowledges the potential role for Indigenous rangers to be involved in monitoring and managing of weeds and this should be encouraged in the conditions of the decision.	management objectives in respect of weeds: • To prevent the introduction and spread of weed species through project activities. • To minimise the potential impacts of weeds on the surrounding environment. Pacific Aluminium has reaffirmed its intent to work closely with the Department of Land Resource Management, landholders and indigenous ranger groups in meeting the above objectives and has commenced recording weed infestations during the 2013 dry season field season (see section 6.2.7 of this EIS Supplement).
6-4 Environment	The KGGP project will traverse over 600kms of largely intact tropical savannas that are globally significant and home to important threatened species and	Additional survey has been conducted and the results provided in Chapter 4 of this EIS Supplement. The survey effort is considered adequate for impact

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Centre NT	habitats. The extensive clearing of native vegetation, the numerous creek and river crossings, and the ongoing construction and maintenance activities will compromise the connectivity of these habitats and threaten endangered and vulnerable species. Given the extent of the pipelines proposed footprint, and the remoteness of the locations, there is a paucity of baseline data available to properly assess and mitigate impacts. Therefore it is recommended that the proponent conduct surveys ahead of the construction activities by a team of biologists and report and adapt their activities. Many of the surveys undertaken were based on single sampling events and so are unlikely to capture seasonally variable flora and fauna species or the full coverage of the pipeline. For example, the aquatic fauna survey was carried out ten years ago from one sampling event from one site, so it is noted by the proponent that it is unlikely that all species were recorded. Further surveys should be carried out at each major river crossing to ensure that drilling operations or open cut operations do not further threaten vulnerable flora and fauna species. Even in river crossings that have very reduced flows, there will be conservation considerations such as retention of riparian vegetation and minimising impacts on pools acting as seasonal refugias that need to be further considered. For example, vulnerable water monitors utilise the riparian vegetation in small streams and creeks that are likely to be impacted upon by open cut trenching so HDD is encouraged for even reduced flow streams and creeks.	assessment purposes. Additional survey (conducted by qualified ecologists) in respected of the Mitchell Ranges realignment has been committed to, along with targeted pre-clearance survey in order to avoid or minimise important habitat for threatened species (e.g. Gouldian Finch breeding habitat). The comment suggests that aquatic sampling was undertaken from one sampling event at one site. This is incorrect. The survey was conducted at 17 sites at or near watercourses proposed to be crossed by the pipeline corridor (section 3.3 of Appendix E to the Draft EIS). This was supplemented by desk top analysis and literature review.
6-5 Environment	Assessment of freshwater fish impacts noted the likelihood of the species occurring in many of the rivers and creeks requiring traversing. The proponent	See section 6.2.3 of this EIS Supplement providing further details on watercourse crossing methodologies and risk assessment and adaptive

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Centre NT	determines that it will not have an impact on the habitat. The proponent states that "pre-clearance inspections will be undertaken at river crossings prior to survey and pegging of the ROW and any construction activity to confirm no waterholes or pools that may provide potential refuge for the Freshwater Sawfish are likely to be affected by construction". It is important that these inspections are undertaken by qualified staff and not tokenistic inspections undertaken by construction contractors. Similarly, HDD operations should have a sufficient buffer to the river bank in these instances.	management process to be applied in respect of watercourses that may provide potential habitat for the Freshwater Sawfish. The process proposes to utilise the advice of an independent sawfish expert.
6-6 Environment Centre NT	The potential of the KGGP project to impact upon Gouldian finch populations is seriously concerning. The Gouldian Finch is listed as Endangered and Migratory under the EPBC Act, and the pipeline traverse highly significant habitat for Gouldian finches. Impacts on such a species habitat cannot be adequately offset elsewhere. Of particular concern is the potential for the pipeline to traverse 'key source populations for breeding or dispersal' such as the areas between KP0 and KP140 including the Beswick/Chambers River area. Survey results also highlight the importance of watercourses and drainage lines that are not in flow for Gouldian finch habitat. Whilst the proponent acknowledges the Gouldian finch survey results and the potential for impacts from the project, we do not believe the proponent has adequately addressed the threats and avoided the impacts. Other alternatives for siting the pipeline need to be examined to ensure most optimum placement for minimal threat to threatened species such as Gouldian Finch populations.	See section 4.5 of this EIS Supplement providing additional survey information and section 5.6.3 providing additional commitments to avoid and minimise disturbance of Gouldian Finch habitat.
6-7 Environment	The use of HDD techniques is welcome for river crossings and should be the method used for at the very least the 10 river crossings recommended by the	See section 6.2.3 of the EIS Supplement providing additional detail on watercourse crossings and a risk assessment and adaptive management

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Centre NT	EcOz report and any that are in flow at the time of construction. The use of HDD for other watercourses should not be determined by the construction contractor, but instead properly assessed by a qualified environmental officer. We strongly recommend that open cut trenching is avoided and HDD be the preferred method at even reduced flow streams and creeks to minimise disturbance on riparian vegetation. It is also important that the use of HDD techniques minimises the impacts on riparian vegetation and that the rig is set back sufficiently to reduce risks of erosion and silting during drilling operations. Control of erosion and sedimentation will be critical for maintaining the health of all waterways that are traversed in the project. The root systems of riparian vegetation will in many cases be providing important bank stabilisation functions and so an adequate buffer will be important to ensure these functions are maintained. For the open cut crossing of watercourses that are not in flow it is important that the applicant avoid unnecessary damage to riparian vegetation and river banks. These areas should be targeted as priorities for revegetation and bank stabilisation methods should be prioritised and monitored during the subsequent wet seasons. Little information is given by the proponent as to how riparian vegetation may be rehabilitated in the process of river crossings. What is the impact of HDD vibrations and noise on freshwater fish? Little scientific information exists in the literature to the nature of HDD impacts on freshwater ecosystems and so this also needs to be considered and made clear in the final EIS.	strategy. The importance of riparian vegetation has been acknowledged in the Draft EIS and additional detail on the implementation of a Risk Assessment and Adaptive Management Strategy for watercourse crossings and implementation of HDD is provided in section 6.2.3 of this EIS Supplement. Further details on the reinstatement of open cut watercourses are provided in section 6.2.3 of this EIS Supplement. Stabilisation of banks is a key objective for rehabilitation. Vibration and noise transmission to the aquatic environment resulting from use of HDD techniques are expected to be negligible. No blasting is proposed near watercourses in flow.
7-1 Northern	The Draft EIS does not address the risk of materials failure. The underlying	Manufacturer, or Supplier, prequalification is necessary and supplier material will

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Land Council	assumption that the manufacturer will apply appropriate quality control procedures during manufacture of prefabricated materials being transported to the project should be qualified by description of the manufacturer's quality control procedures and a projected rate of materials failure in the Supplementary EIS.	be subject to Manufacturing Procedure Qualification Testing (MPQT) prior to contract award. In addition, Technical Bid Evaluations aim to ensure suppliers are chosen based on ability to meet project quality control and health and safety requirements. During manufacturing, pipe will be made and tested in the pipe mill to Australian Standards including hydrostatic testing (hydro-testing) and the weld seams will be required to meet 100% Ultrasonic Inspection. Quality inspectors will be present in the manufacturing facilities for the duration of the manufacturing process to ensure all required standards and processes meet project specifications. Upon installation the line pipe will undergo hydrotesting again and all field welds will be 100% non-destructively tested. The testing records will be logged and preserved for the life of the pipeline and all records are GPS located. The pipeline is being designed to the latest requirements of AS2885 and the pipeline is intended to meet current best design practices. Inspection and maintenance procedures will be best practice and formulated during detailed design to ensure the 50 year design life is met. Best practice requirements include features such as a durable, service specific external coating which provides protection to the steel as well as a cathodic protection system which helps prevent pipe corrosion. The coating is fully checked and tested prior to backfill to ensure there are no holidays (i.e. areas of bare steel) and records are kept for verification. Aside from these design features, the pipeline integrity will also be inspected every 5 years using smart pig technology. Smart pigs are tools that runs down the inside of the pipe taking measurements of pipe wall

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		thickness, helps find areas of dents or damage and can verify if there is any micro-cracking in the pipe. During construction the pipeline is protected by ensuring the trench is free of rocks or other features that could damage the pipeline during installation and the backfill material is also quality controlled to avoid damaging the pipe.
7-2 Northern Land Council	Pipeline lengths may corrode in the saline environment and/or become damaged during transit or handling. The risk of damage during construction and handling and those measures required to mitigate this risk (e.g. visual inspection for damage prior to use) should be addressed in the EIS.	There are very specific requirements on how the pipe must be handled, stored and transported to maintain quality integrity. This includes things such as stacking the pipe in a way that avoids overstressing, covering the pipe if it is to be stored for a long duration before installation, loading and strapping in ships and utilizing vacuum lifts when handling. Pipe transportation requirements are communicated to necessary stakeholders through specifications and contract requirements. Quality inspectors will also be present over the duration of the process, from the start of manufacturing to the end of construction to ensure all standards are met and any damaged material is rejected and/or quarantined to avoid being installed.
7-3 Northern Land Council	It is advised that protective epoxy coatings are to be applied at time of pipe manufacture. By necessity, a length at the end of each pipe (usually about 100mm) must remain uncoated to allow for welding. Once each section has been welded, coating must be applied around each joint in the field. This practice will create a chemical (or hazardous substances) risk to the environment every 17.6m along the pipeline. The EIS should acknowledge coating of weld joints and address the risks posed by the hazardous nature of the coating to be applied post-welding (i.e. toxicity and flammability).	There is inorganic zinc silicate weld through primer applied to each pipe end in the factory. This is a very thin coat that ‘holds’ the factory applied surface preparation which then minimises surface blast cleaning requirements in the field and thus reduces environmental impact. There will be no epoxy coating at the pipe ends – each pipe end will have an external cutback of 150 mm. The internal surface of the pipe is also coated with a thin epoxy film (flow coating). This has a different cutback at approximately 100 mm. The flow coating is aimed at improving hydraulic characteristics of the pipe, but also provides a level of corrosion protection, though that is not the

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		intent of the internal lining. For field joint coatings, the project prefers to use fully automated surface preparation and coating application on each field joint. This allows a high degree of quality control during surface preparation and coating work, further reducing the impact to the environment. This comes at a higher cost than the usually used manually held surface preparation and hand held spraying equipment typically used to date on Australian pipeline field jointing work. Using this system will help reduce personnel exposure to fumes associated with coating processes, though regardless of what system is used the project will always adhere to manufacturer recommendations regarding personnel protective equipment (PPE) requirements. It should also be stated that no epoxy coatings will be allowed to be welded through as this will contaminate the weld and be detrimental to the operator health. This requirement is covered in the project field joint coating specification under surface preparation.
7-4 Northern Land Council	During construction, the proponent proposes to use a ‘temporary’ cathodic protection system. Detail with respect to the nature of the ‘temporary’ system is not provided. The risks associated with the temporary cathodic system’s materials of construction, operation, and components should be discusses as well as how long the system will be required to remain in place. The proponent advises that permanent cathodic protection system will consist of silicon/cast iron anodes placed into an unbunded petroleum coke backfill. The EIS does not contain any discussion as to whether petroleum coke is a hazardous material or whether the material or the products of its decomposition	The use of temporary anodes for the cathodic protection system applies to the use of galvanic anodes installed in the construction phase of the pipeline. The galvanic anodes usually have a design life of two years, and are intended to be disconnected once the permanent cathodic protection installations have been completed and commissioned. The temporary anodes will be manufactured to comply with AS2239, and consist of magnesium rod anodes, packaged with a mixture of bentonite clay, gypsum and sodium sulphate, and contained within calico bags. For transport and handling purposes, the packaged anodes are contained within plastic bags.

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	are likely to leach into groundwater systems over time. The quantity of coke to be used over the lifetime of the project is not disclosed and consequently the level of risk that this material might pose to the environment and to people has not been assessed. Of particular interest are the volumes and types of evolved gases that will be vented to the atmosphere and the level of contaminants that might pass into groundwater systems when the beds are occasionally watered. The proposed locations of the petroleum coke beds are not disclosed. Any risks associated with petroleum coke or its breakdown products may become compounded if the beds are placed in locations where soils are fragile or free-draining (e.g. kandosol and/or tenosol deposits). The EIS should provide detail on risks associated with the proposed cathodic protection systems and appropriate management plans. The potential for contamination of groundwater by leachates from petroleum coke backfill proposed as part of the cathodic protection system has not been considered. This risk may be increased if petroleum coke is buried in areas where the soil structure consists largely of free draining kandosols and/or tenosols. Appendix O recommends mitigation measures for chemical spills in tables 3-2 and 3-3. Petroleum coke is subject to deliberate burial, so the mitigations and indicators are not applicable. Risk of groundwater contamination by petroleum coke should be assessed separately and included in the Supplementary EIS.	The use of calcined petroleum coke in conjunction with various materials used as impressed current anodes is common within Australia, and worldwide. The material is non-hazardous, non-toxic, non-carcinogenic and inert. The coke is manufactured in the USA, and products from the recommended manufacturer have been used on projects in Australia for at least 30 years with no adverse reports on its' usage. MSDS data available shows HMIS/NEPA hazard ratings as: Health – 1 (Minimal), Fire – 0, Reactivity – 0. During the lifetime of the permanent cathodic protection system, there will be some dissipation of the calcined petroleum coke due the electro-chemical reaction of the anode system, with no leaching into groundwater. The manufacturer's information is that the product proposed for the project – Loresco SC.3 – is NSF certified for contact with potable water. There is likely to be some very small volumes of carbon dioxide gas evolved from the electrolytic reaction of the anode system(s). Due to the very low cathodic protection current densities required to be applied to the pipeline, and thus low current applied to the anode system(s) gas evolution will be extremely low and can be considered insignificant. Calculations on gas evolution can be completed on a theoretical basis once detailed design has been completed. The quantity of calcined petroleum coke will be determined during detailed design, and after the soil resistivity survey has been completed. The preliminary design has proposed the installation of canistered anodes, where the anode and calcined petroleum coke are contained within a steel casing approximately 2m long with a diameter of 200 mm. Using canistered anodes help avoid loose

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		calcined petroleum coke at any site. The quantity of anodes at each cathodic protection installation, and the final locations, will be defined during detailed design. It is intended that the anode systems (groundbeds) at each cathodic protection installation be in augured holes 3m deep, and 100 m to 150 m away from the pipeline. A soil resistivity survey is being completed prior to detailed design to verify the suitability of each proposed installation site. This would also note physical details such as possible washouts.
7-5 Northern Land Council	While the maps provided in Figures 3-1 and 3-2 provide an indicative route for the KGGP, they are incomplete or not correct. Surveys are not complete on areas near the northern extent of the Mitchell Ranges as they were not surveyed in 2004 or 2012. There are some significant cultural concerns associated with the Mitchell Ranges, so consultation with Traditional Aboriginal Owners is required to finalise the KGGP route. Further deviations in this part of the pipeline alignment may be required following consultation and surveying in this area. Traditional Aboriginal Owners should be present at all times during additional survey work to ensure that cultural mapping is complete and survey personnel do not inadvertently intrude on culturally significant sites. The updated maps and discussions of any further deviations should be presented in the Supplementary EIS, however details of culturally sensitive sites and reasons for any deviations (should they be of a cultural origin) should be withheld.	The Draft EIS puts forward the preferred route for the KGGP however, it is acknowledged that landholder discussions will influence final design and route selection (see section 1.10 and 3.3.3 of the Draft EIS). Pacific Aluminium has been in detailed discussion and consultation with the NLC and Aboriginal traditional owners during on-site field reconnaissance of the project area during July 2013. This consultation will be ongoing. Pacific Aluminium confirms that all survey work has been and will be undertaken in the presence of Aboriginal traditional owners and in accordance with the *Aboriginal Land Rights (Northern Territory) Act* and *Northern Territory Aboriginal Sacred Sites Act*. The particular cultural sensitivity of the pipeline alignment in the vicinity of the Mitchell Ranges is acknowledged and an alternative alignment developed in consultation with the NLC and Aboriginal traditional owners is addressed in section 5.15 of this EIS Supplement.

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7-6 Northern Land Council	The possibility of alternative routes for the pipeline (e.g. through Ngukurr/Numbulwar from Armour Energy's gas field near Borroloola); or the Gove Lateral have not been discussed. Although they may be unviable, they should be included in the EIS because their unavailability provides additional justification for the proposed KGGP route.	The priority for the transportation of gas to Nhulunbuy is to provide an alternative energy source for the Gove alumina refinery. The current known gas supplies in the NT are from fields which connect to the Amadeus pipeline. The KGGP project is based on the previous TTP route. During earlier discussions with key stakeholders about the proposed pipeline route it was agreed a take-off point would be at the Amadeus Pipeline, as the immediate priority is to secure known gas supply for the alumina refinery. Unfortunately prospective gas fields within the region are unable to meet the timeframes required to secure gas for the alumina refinery, however the pipeline infrastructure will provide a gas market for further exploration. Pacific Aluminium has had discussions with Armour Energy and will continue to do so to understand the future exploration activities within the region.
7-7 Northern Land Council	Risks associated with earthquakes have not been adequately addressed in the Draft EIS. The document provides no detailed analysis of seismic activity in areas along the KGGP route, even though the pipeline crosses known faults. The data provided in the Draft EIS relates to areas that are too distant (700 – 1600km) to bear relevance to this project; if there are no records for locations along the route, this should be stated. Appendix N indicates that the KGGP route passes through 11 zones that have the potential to be impacted by earthquakes. It identifies the need to undertake a detailed assessment of fault lines and seismic activity along the entire route. This assessment should be completed, a formal risk assessment undertaken and the outcomes (including any management plans) provided in the	See section 6.2.2 of this EIS Supplement.

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	Supplementary EIS. Given that earthquakes have been identified as a hazard with potential to damage the pipeline, final construction should employ techniques and materials which mitigate the risk of damage in case of earthquakes. Section 6.1.2 should revise the commitment to further investigate the use of suitable materials for mitigation of earthquake risk, to a commitment to utilise such materials.	
7-8 Northern Land Council	The Draft EIS recognizes the importance of two Indigenous Protected Areas (IPA) crossed by the pipeline but is inconsistent in the way they are considered. It is stated that the pipeline corridor passes through the northern section of the Dhimurru IPA (p4-14), but it does not state that it also passes through the Laynhapuy IPA. This should be recognized and corrected so the text is consistent with Figure 4-3 and Figure 11-1.	Section 4.2.8 (p4-14) of the Draft EIS incorrectly omitted the Laynhapuy IPA in the context of the pipeline route and the relevant sentence should read: "The pipeline corridor passes through the northern sections of the Dhimurru and Laynhapuy IPAs (Figure 11-1)". This omission is however, incidental and section 11.2 of the Draft EIS gives a full account of potential impacts and management responses in respect of both IPAs proposed to be traversed by the KGGP.
7-9 Northern Land Council	The EIS (p4-19) refers to Tables: 4-21; 4-23; and 4-26 in Appendix M. These Tables do not exist.	Table 4-21 comprised a summary table of 17 industry sectors in Nhulunbuy, contributing to its Gross Regional Product in 2009, and Table 4-23 listed the number of employees in 20 industry sectors in Nhulunbuy, from data from the 2006 ABS Census. The source document for these summary tables is East Arnhem and the Region's Economic Data at a Glance, prepared by the Northern Territory Government. It is available at the following website: http://www.rdia.nt.gov.au/__data/assets/pdf_file/0006/98493/EastArnhemRegion_At_a_glance_2010.pdf Table 4-26 included a small number of statistics, relating to percentage of jobs in the two industry sectors employing the largest number of Yirrkala residents

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		(Public Administration and Safety; and Education and Training; 75% of filled non-CDEP jobs), taken from a Northern Territory Government publication: Jobs Profile – Yirrkala, available at the following website: http://www.drdia.nt.gov.au/__data/assets/pdf_file/0004/143491/Yirrkala_Jobs_Profile_2011.pdf The page numbering in the second major section of Appendix M is in error. For the first part, the Social Impact Assessment, the page numbers run consecutively from 1 to 60; however, the second major section, the Social Impact Management Plan, commences with page 61 but then the page numbers 2, 3, etc. instead of 62, 63, etc.
7-10 Northern Land Council	Alternative, traditional economies are not recognized in the EIS. Aboriginal people hold considerable ecological knowledge associated with customary use of plants and animals for food, cultural practices and art. All species have value, even if that value cannot be expressed in monetary terms. Harvesting of plants and animals for customary use can be important to the maintenance of social networks and contribute substantially to the indigenous economy. Subsistence level economic activity should be recognized and reported in the Supplementary EIS as it may lead to identification of further risks that will require mitigation. The definition of what constitutes a species of conservation significance (p 8-2) should be widened to include keystone species of major socio-economic or cultural value to Aboriginal people. This may result in additional risk assessment and development of specific management plans that should be provided in the	Section 4.3.3 of the Draft EIS acknowledges Indigenous customary use of natural resources in addition to the active role that five Indigenous Ranger Groups play in the pipeline region. While these customary uses are acknowledged, the small area of land clearing, minor disturbance to aquatic environments and measures to be taken to rehabilitate disturbed areas, are expected to result in few direct impacts on subsistence level economic activity in the region. Conservation significance has not been defined to include aspects of socio-economic or cultural value however as per above, these values have been generally acknowledged but are not expected to be significantly affected by the KGGP Project.

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7-11 Northern Land Council	While the Pacific Aluminium Gove operations constitute the largest regional mining venture affected by the pipeline, the KGGP route also crosses a number of exploration tenements where companies (e.g. BHP-Billiton and Rio Tinto) are actively engaged in minerals exploration. Although the economic stimulus from minerals exploration is small in comparison to that of Pacific Aluminium, it has the potential to increase significantly should economically viable deposits be discovered. Impact upon these (or parts of these) deposits by the ROW would diminish the benefits that would otherwise accrue to the region from their exploitation. The existence of these exploration activities and their potential for development should be discussed in the EIS. Pacific Aluminium indicates that because the amount of land affected by the permanency of the ROW would comprise only a *"very small proportion of any one mining lease"* loss of access to this land is expected to be negligible. The extent of impact may be considerable should the ROW prevent development of all or part of an economically viable deposit identified in the future (refer also to comments on Chapter 4). The true level of potential impact is economic but currently unknown and will remain so until such time as exploration in and around the immediate vicinity of the ROW is undertaken. This should be acknowledged in the Supplementary EIS.	The existence of the KGGP within the pipeline region is expected to have minor impacts on either prospective or existing exploration permits in the region. The construction footprint of the pipeline component of the project is approximately 1,800 hectares, comprising a very small proportion of the wider region and any prospective exploration leases. In addition to the information contained with the Draft EIS, Pacific Aluminium will advise tenements holders of its intention to apply for a Pipeline Licence pursuant to the *Energy Pipelines Act*. The operational footprint of the KGGP will be considerably less as a minimal buffer to exploration, mining or petroleum activities is required to be maintained around the pipeline for safety reasons. If potential issues arise in respect to extant or future mining or petroleum leases, Pacific Aluminium will enter into discussions with those entities with a view to resolving, while maintaining safety for the pipeline. It should also be noted that while not an objective of the KGGP project, the existence of the pipeline increases the demand for natural gas and potentially provides power options for future economic enterprises in the region that may make such enterprises more viable and offset any small impacts on resource recovery.
7-12 Northern Land Council	It should be noted that weightings of the level of risk are subjective and do not necessarily reflect the levels of concern that might be held by Aboriginal people. The NLC takes this opportunity to note that any discrepancies of this nature	The comment in respect of different perceptions of risk through different cultural values is acknowledged. Pacific Aluminium's ongoing commitment to engagement with Aboriginal traditional owners throughout the life of the KGGP

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	should be overcome provided Pacific Aluminium maintains consistent and on-going dialogue with Traditional Aboriginal Owners throughout the life of the project.	project is identified in section 1.10 of the Draft EIS and further demonstrated in the consultative efforts documented in section 6.2.11 of this EIS Supplement. Further, Pacific Aluminium acknowledges that perceptions of risk are subjective and that this risk may be mitigated through ongoing dialogue between landowners and the proponent. To this end, Pacific Aluminium has committed to fund a Land Liaison Officer and a Cultural Heritage Officer as part of the KGGP. These Officers will work with KGGP and the NLC to facilitate the relationship between the Project and landowners in relation to land, cultural heritage and environmental management and also provide ongoing status updates about the progress of the Project.
7-13 Northern Land Council	No specific commitments to investigate the extent of the karst formation/s within the KPPG Project area are provided, and there is no adequate delineation of methods by which impacts on karst formations will be mitigated. Although it is written in the Draft EIS “Impacts on karst formations will be avoided” under the anticipated effects mitigation column, no information is provided as to how this will be achieved, should karst formations are encountered along the pipeline ROW or along any of the access or maintenance tracks. Is there a training program to enable KGGP Project workers or Contractors to competently identify karst formations and associated habitats if encountered in the field? The EIS contradicts itself in stating that ‘the proposed pipeline route commences and extends east across a karst landscape’ (p 6-4), then later suggesting there is only the potential for karst formations to be present (p 6-14). This contradiction should be rectified, or each of the statements clarified. Given karst	See section 6.2.2 of this EIS Supplement.

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	landscapes in and around the connection point at Katherine are known (as is indicated in the Draft EIS), and a sinkhole was previously identified (at approximately KP511.6) in 2004, there should be a commitment to undertake further field investigations particularly in the KP486 to KP560 region. The Draft EIS states that "further evaluation is therefore warranted in this area" (p 6-4), falling short of providing a commitment to undertake a thorough evaluation. Karst landscapes and habitats are often associated with species endemism and specialization; furthermore there is potential for sinkholes to occur in karst formation areas. A specific karst deposits management plan should be included in the EIS. Following completion of survey work planned for 2013, this karst management plan should be provided in the Supplementary EIS.	
7-14 Northern Land Council	The extent of potential damage to soils (particularly soil stability and acid sulfate generation), and description of methods to mitigate this potential damage is not properly described in the Draft EIS. The KGGP route contains long stretches of sand containing mainly kandosols and tenosols (p 6-7) and these areas will be susceptible to damage by heavy construction vehicles. Kandosols and tenosolos are often fragile and have a high porosity, which them susceptible to erosion and contamination. Once damaged, their ability to maintain vegetation may be compromised. Additional strategies and mitigation measures for this specific risk should be considered and included in the Supplementary EIS. As a proposed mitigation action (under avoidance) it is stated that, *"Construction activities involving significant land disturbance would be confined to the Dry Season, wherever possible"*. This is an inadequate commitment given the	The measures proposed in the Provisional Soil and Landform Plan (Draft EIS, Appendix O) and further development of an Erosion and Sediment Control Plan as part of the Construction EMP, will adequately manage impacts to soil stability. Further information on management of soils is provided in section 6.2.2 of this EIS Supplement. See section 6.2.3 of this EIS Supplement regarding the weather assessment conducted to assist planning and scheduling of construction.

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	significant potential for soil erosion to occur and also the potential for heavy machinery and other equipment to become bogged and stranded if such works were to be conducted during the Wet Season. The Draft EIS document should be amended to read that all construction activities will be "*confined to the Dry Season, at all times*".	
7-15 Northern Land Council	Horizontal Directional Drilling (HDD) and open trenching are the proposed construction methods for installing the pipeline across watercourse intersections. It is stated that nine watercourses have been identified as "potentially requiring HDD for ecological and engineering reasons" and that HDD would also be used for crossing any watercourses determined to be in flow at the time of construction. These statements do not constitute a commitment by the KGGP Project to utilise HDD at any of the identified watercourse crossings along the pipeline route. The Draft KGGP EIS states that the pipeline will cross 26 'major watercourses'; we may therefore assume the open trenching method is the preferred method to lay pipeline across at least 15 of the 26 major watercourses that have been identified within the pipeline ROW. The open trenching method of installing pipeline across watercourses will result in an increased risk of soil erosion and riverbank instability, and will require the clearing of more riparian vegetation than would HDD. For this reason it is recommended that HDD be considered by the KGGP Project as the preferred construction method for installing the pipeline at all watercourse crossings. As a proposed mitigation action (under avoidance) it is written that HDD	See section 6.2.3 of the EIS Supplement providing a Risk Assessment and Adaptive Management approach to watercourse crossings. See section 6.2.3 of the EIS Supplement providing additional detail on reinstatement, rehabilitation, maintenance and monitoring of watercourse crossings.

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	construction methods will be used at 'sensitive' watercourse crossings. What is meant here by the term 'sensitive'? Elsewhere in the Draft EIS document watercourses are described as being 'major', indicating a larger size watercourse. For avoidance of doubt terminology should be definitive and consistent throughout the EIS.	
7-16 Northern Land Council	HDD will require mobilisation of drilling equipment to and from the watercourse crossing sites (on both sides of the river or creek) and therefore the benefits of protecting a small area of high conservation value riparian forest may need to be weighed against the potential costs and impacts of such access, in some cases over considerable distances, to the drill sites. Given the complexity of this issue, NLC recommends site-specific decisions on which method (HDD or open trenching) to engage, with the views of Traditional Aboriginal Owners a key consideration in decision-making at each site. Pacific Aluminium should commit to a decision making protocol that includes consultation with Traditional Owners of each site.	See section 6.2.3 of this EIS Supplement detailing a Risk Assessment and Adaptive Management approach to watercourse crossings. Pacific Aluminium has committed to engage a land liaison officer and cultural heritage officer as part of the agreement with the NLC. These roles will work closely with the construction team to ensure Aboriginal traditional owners and impacted ranger group representatives are present when final design and construction method is agreed at each specific HDD site. The approved disturbance footprint for each of these crossing will need to balance all stakeholder interests.
7-17 Northern Land Council	Proposed investigation and mitigation of risks associated with slope instability are inadequate. Where significant potential for landslides and slope instability are identified, the proponent should commit to the development of an adaptive management strategy prior to undertaking construction activities in that area. The current proposed mitigation action (under minimisation) should be amended as follows, "*appropriate soil conservation works would be installed, routinely inspected and maintained to prevent mass movement and safely control runoff*".	Ongoing technical investigations during the design phase coupled with mitigation measures to be applied through the EMP (for example the Provisional Soil and Landform Management Plan) will ensure that the risks associated with slope instability are adequate.
7-18 Northern	The assessment and treatment of Acid Sulfate Soils provided in the EIS is	See section 6.2.2 of this EIS Supplement.

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Land Council	inadequate. Assessment is based on desk-top research only and is not supported by field observations or direct scientific measure. There is no Acid Sulfate Soils management plan, only a proposal to undertake field assessments ahead of the construction. However, Pacific Aluminium is not clear about exactly when these assessments will be undertaken (i.e. whether it will be during the 2013 dry season, or immediately ahead of the construction crews). The timing of the plan's development is important because if field assessment is undertaken once construction has commenced in affected areas, it is unlikely that a satisfactory management plan will be established. A firm commitment to undertaking field assessment and developing the plan in 2013 should be given and this information provided in the Supplementary EIS. If ASS are encountered and interacted with or disturbed in any way during construction of the KGGP Project, in each instance information about exactly where the ASS were located, and how they were managed, should to be communicated to the Traditional Aboriginal Owners and other local Aboriginal people via NLC. If ASS are disturbed and covered with water again there is the potential to alter the waters' pH level and to release heavy metals into affected waterways.	Pacific Aluminium through land liaison officers will ensure ongoing communication and project specific information is provided to Aboriginal traditional owners.
7-19 Northern Land Council	It should be explicitly stated here that hydrocarbon spill kits would be provided in all refuelling areas. Additionally the word 'adequately' should be placed in front of the word 'bunded' in order to convey that the design and size of the bunding will be suitable to contain any leak or spill of hazardous liquids, in case the hazardous liquids storage containers and/or systems should fail. Where it is currently stated that "*Each construction site will have an approved*	See section 6.3.4 of Draft EIS: Soil contamination. The proponent will ensure that hydrocarbon spill kits are provided in all refuelling areas, in addition to all hydrocarbon storage areas, and that all personal handling such substances or involved with refuelling are trained (inducted) in both preventing spills and effectively responding to spills, including sound disposal of absorbent pads and other materials used to mop up spilled hydrocarbon, in addition to spilled fuel

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	emergency plan and spill kits to deal with accidental spills", it should be added that all project workers and contractors will be inducted and trained in this emergency plan, including how to 'effectively' deal with accidental spills. For effective management of liquid waste disposal and spills and leaks, all KGGP staff need to be inducted and trained to competently handle and dispose of all waste and especially hazardous liquids such as chemicals and hydrocarbons. Although the potential for contamination by chemical and fuel spills is generically discussed, there are some specific risks related to petroleum coke, hydrotest water and stormwater that are unlikely to be mitigated by the proposed measures. Under minimisation it states that spill kits will be provided at *"all chemical storage facilities"*; spill kits should additionally be provided at all hydrocarbon storage facilities.	recovered from bunded areas. These measures will be outlined in an approved Emergency Spill Plan. The final Soil and Landform Management Plan will make explicit that bunds design will be adequate to contain the largest potential spilled volume. Response above on hydrocarbons will also apply to chemical storage and dispensing areas. In relation to potential soil or water contamination by petroleum coke, anode grade petroleum coke is low in sulphur and metals, and the MSDS indicates that it is insoluble in water and stable under normal conditions; therefore, the risk of soil or water contamination is considered low. Regarding safe disposal of hydrotest water, see section 6.2.4 of this EIS Supplement. Release of hydrotest water will comply with environmental safeguards determined by CSIRO and adopted by the Australian Government as a standard that protects biota. Regarding stormwater management, the EMP includes a Hydrology and Water Quality Management implementation strategy (Table 4-2) that includes development and implementation of a Stormwater Management Plan and construction of stormwater management works, including diversion drains, sedimentation/detention basins, internal site straining and bunding of contamination risk areas. Table 4-3 includes a commitment to visually inspect all stormwater management devises to ensure their ongoing effectiveness in preventing contamination of waterways.
7-20 Northern	The proposed KGGP poses significant risks to water resources. Impacts are exacerbated because of the reliance of remote communities on water sources	See section 6.2.5 of this EIS Supplement. The water needs of the project are short duration, temporary and are not large. Nevertheless, the potential for

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Land Council	impacted along the pipeline route. Ground water and surface water extraction must not impact on the current water requirements of local communities. Care must be taken to ensure that any extraction of ground water does not affect the flow of springs of cultural significance. The EIS needs to give more consideration to the potential impacts of KGGP Project activities on locally and regionally significant aquifers that are known to be present throughout the Project area. Appropriate planning and management actions are required to properly mitigate the risk of potential damage to any fresh water aquifer as a result of KGGP Project activities.	temporary impacts on local water resources is acknowledge in Chapter 7 of the Draft EIS and will be managed through the development of the implementation of the Water Supply and Adaptive Management Strategy and the EMP (Draft EIS, Appendix O. Provisional Hydrology and Water Quality Management Plan and Provisional Terrestrial and Aquatic Fauna and Habitat Management Plan).
7-21 Northern Land Council	Several watercourses to be crossed by the proposed pipeline provide the potable water supply for downstream Aboriginal Outstations, additionally in some areas the pipeline route is upstream of important cultural sites. Additional consultations with affected Traditional Aboriginal Owners and other local Aboriginal people will be required prior to construction work being undertaken in these areas. The EIS should further demonstrate the proponent's commitment to ongoing dialogue and responsiveness to Traditional Owner concerns about water resources in decision-making.	Pacific Aluminium acknowledges the important role Aboriginal traditional owners will have prior and during construction activities to identify areas of cultural significance. Members of the design and construction team accompanied NLC officers and Traditional Owners to undertake visual field assessments of the proposed pipeline route in July and August 2013. This early field work has enabled members of the project team to develop relationships with traditional owners and land owners to gather local knowledge and capture important information into the project design. Pacific Aluminium has committed to ensure ongoing communication and direct involvement through the NLC with Traditional Owners is maintained. A Land Access Protocol is to be developed and will be implemented by all project staff.
7-22 Northern Land Council	There is a risk that water demand will exceed supply later in the dry season. Data provided in Table 7-3 indicates that demand for surface water will possibly exceed allowable extraction in August and September 2014 at King River and Beswick Creek. Risks to communities potentially affected by reduced surface	See section 6.2.5 of this EIS Supplement.

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	water flow in these watercourses are not discussed. The anticipated reduction in flow should be balanced against known water consumption from the watercourses, the risks to communities assessed and provided in the Supplementary EIS. The Draft EIS describes a scenario by which between 25 – 50 % of the total surface water flow may be extracted from the King River and Beswick Creek watercourses during August and September (p. 7-9). The Northern Territory Government (NTG) water management guideline aims to ensure that no less than 80% of the natural flow in surface watercourses is available for environmental flow. Cumulative planned extractions should be limited to the 20% of natural flow usage threshold, from these and any other watercourses in the Project area; when the 20% usage threshold has been reached, alternative water sources should be investigated and engaged where possible. The Draft EIS states that construction and the operation of the KGGP Project is not expected to result in significant impacts on hydrological values, however this assertion is not yet adequately qualified by the water resource management measures proposed.	
7-23 Northern Land Council	Under subheading *'Degradation of water quality'* the word *'developed'* should be replaced with new term *'implemented'*, so that the sentence reads: *"… and a Hydrology and Water Quality Management Plan would be implemented to ensure construction activities do no impact water quality…"* (pg.9-26).	The intent is that the Hydrology and Water Quality Plan would be developed and implemented.
7-24 Northern	There are several issues related to hydrotesting that require clarification. The	Hydrotesting will not be undertaken during the operating period of the pipeline.

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Land Council	EIS refers to hydrotesting during construction only. It should also indicate a proposed schedule for hydrotesting if periodic testing is to be undertaken during the proposed 50 year operational period.	Other pipeline inspection techniques such as pipeline inspection gauges (pigs) will be used to monitor pipeline condition during the service life. In the event of a future requirement to conduct a repair involving cutting out a section of the pipeline and replacing it, all newly installed line pipe will be pre-hydrotested before installation such that no hydrotesting of the actual pipeline will be required.
7-25 Northern Land Council	Pacific Aluminium proposes to dispose of hydrotest water by land application to stable (rocky) vegetated areas to minimise direct impacts on surface water quality and wetland environments (Appendix B Section 6.3.2.2). While this will mitigate the risk of immediate transport into watercourses, chemical species dissolved in the water will remain on the surface as evaporates and may wash into watercourses during subsequent rainfall periods. Hydrotest water should be discharged into purpose built evaporation ponds that are lined with an impermeable membrane (plastic, clay, etc.). The EIS should describe the locations of these evaporation ponds, and the risks associated with them. Many of the chemical species contained in hydrotest water are toxic. Of the chemical species listed in Table 7-7, As, Cd, Cr (VI) and Pb can all be detrimental to human health. The concentration and chemical composition of Biocides and oxygen scavengers, which may also be present, are not provided. Although the Draft EIS provides a table indicating the maximum concentrations of each species permissible for disposal, there is inadequate discussion with respect to the health risk at those levels. In addition to the maximum concentrations for permissible disposal, typical concentrations of potentially harmful chemical species contained within hydrotest water should be provided in	See section 6.2.4 of this EIS Supplement.

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	the Supplementary EIS. The EIS does not contain a hydrotest management plan. Pacific Aluminium indicates that this plan is to be developed during the design phase of the project. Information related evaporation ponds and chemical concentrations should be included in the plan and the plan included in the Supplementary EIS. As a proposed mitigation action (under minimisation) it is written, "*hydrotest water will be disposed of by ground application in a stable environment"*. This statement provides insufficient detail to demonstrate that the hydrotest water disposal methods are safe and have been properly considered. Furthermore the views of Traditional Owners in relation to disposal methods should be considered.	
7-26 Northern Land Council	Pacific Aluminium indicates it will develop stormwater and drainage management systems for facility sites including compressor and scraper stations Table 7-8 (p 7-22). These are areas where oil is likely to come into contact with stormwater, so Pacific Aluminium should make a commitment to design this facility so that there is no discharge of oily water emulsions or oil into watercourses near these locations.	It is the intention that only clean stormwater would be discharged to the wider environment and stormwater and drainage management will be directed towards this outcome.
7-27 Northern Land Council	Performance indicators provided in Appendix O table 4-1 are inadequate for dealing with chemical spills and contamination of water sources. Management of these risks would benefit from chemical monitoring that produces demonstrable data. A commitment to water quality monitoring should be included in table 4-1 and other appropriate parts of the Supplementary EIS.	The measures outlined in response to comment 7-19 to protect water quality of surface water (e.g. adequate bunding and spill response plans and training in areas for chemical and hydrocarbon storage and refuelling; compliance with limits on chemicals in hydrotest water to be discharged; regularly inspected stormwater infrastructure at ancillary locations, such as the compressor and scraper stations) , combined with the short time-period during which construction will take place reduce risks of contamination to a level considered

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		too small to justify conducting routine water quality monitoring over the 600 km long project area.
7-28 Northern Land Council	Several points here require qualification, the Draft EIS states; • That the Construction phase will be temporary and that disturbed areas will be *'rehabilitated as soon as practicable'*. This phrase should be defined in quantitative terms such as time (days) taken to complete rehabilitation works once construction works had been completed in any particular area. • That *'Construction will occur largely during the dry season when many watercourses will be dry'*. The proponent should make a commitment to confining construction work only to the Dry Season. • That "*HDD construction will be used for at least nine watercourse crossings",* provides a commitment (by virtue of use of "will"), whereas on Pg.7-12 of this same report it is stated that *"nine watercourses have been identified as potentially requiring HDD construction"*. These two statements appear to be contradictory and indicate to the reader that a final decision about this matter has not yet been determined.	Additional details on reinstatement and rehabilitation at watercourses is provided in section 6.2.3 of this EIS Supplement. See section 6.2.3 of this EIS Supplement regarding the application of a weather assessment to the construction schedule and providing further details on watercourse crossing including a Risk Assessment and Adaptive Management approach.
7-29 Northern Land Council	The final proposed mitigation action (under minimisation) states that *"drainage in and adjacent to known Gouldian Finch water sources and/or seasonal wetland areas will be reinstated as soon as practicable following construction"*. Given the that the Gouldian Finch is listed as endangered (EPBC status) and that the KGGP Project has given numerous commitments to protect known Gouldian Finch water resources, including a commitment not to extract groundwater "*in areas where extraction could foreseeably alter the hydrological regime of known*	The two references to mitigation relate to different potential impacts. The first reference relates to disturbance to drainage lines at watercourse crossings and the second reference relates to extraction of groundwater in respect of important water resources for the Gouldian Finch. The two are not considered to be in contradiction. See section 6.2.3 of this EIS Supplement for additional detail on watercourse crossings and section 5.6.3 for additional assessment and mitigation measures

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	Gouldian Finch water resources and/or regionally significant wetlands" (Pg.7-11). According to this commitment there should be no need to reinstate drainage to these areas as this drainage should not be disturbed or altered in the first instance. Additionally if any such disturbance is effected it should be written into the Draft EIS that it will be reinstated 'immediately' (within a specified time period) rather than 'as soon as practicable' as currently written.	relating to the Gouldian Finch.
7-30 Northern Land Council	Under the anticipated effect of mitigation column it states that the *"stream bed and banks are reinstated to original profile"*. For consistency the term 'stream' should be replaced with 'watercourse', additionally it should also be mentioned here that 'the watercourse banks will be revegetated with suitable riparian native species'.	See section 6.2.3 of this EIS Supplement.
7-31 Northern Land Council	It is noted that due to dry conditions and fire occurrences prior to and at the time of flora surveys, many of the annual understory species typical of the vegetation communities surveyed were absent. For this reason, additional surveys at a time when the understory species are more likely to be present should be conducted.	See Chapter 4 of this EIS Supplement. Where appropriate targeted pre-clearance surveys for specific flora species will be undertaken. This will complement the additional more detailed vegetation mapping presented in section 4.1 and Appendix C of this EIS Supplement, as providing additional information upon which to base management decisions for the project.
7-32 Northern Land Council	Two threatened species (*Arenga australasica* and *Cycas armstrongii*) were previously reported along the KGGP route. One is no longer considered to be present because the taxon name has been changed; while the second has been dismissed as incorrect recordings. Both are no longer considered to be present in the area and have consequently been excluded from management plans. A change in taxon name or supposed incorrect recording should not be considered a valid reason for exclusion of these two species from the EIS. It is recommended that the precautionary principle should apply and that additional	The NT Herbarium's highly regarded scientists, with decades of experience in identifying the Territory's flora, have advised that neither of these species occurs or is likely to occur in the project area. Additional survey work is therefore not justified.

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	survey work should be undertaken to definitively assess whether or not these species are actually present.	
7-33 Northern Land Council	The Draft EIS understates environmental risk presented by weed incursion; for example "…e*ven with mitigation and management measures in place, a low potential remains for … vegetation communities to be significantly impacted by the introduction and spread of weeds"* (p 8-29). Introduction and spread of weeds is one of the most significant risks associated with the KGGP project. Pacific Aluminium indicates that hygiene measures will be implemented to deal with the introduction and spread of exotic species (Table 8-4, Appendix O table 16.2) but does not clearly specify these hygiene measures. No mention is made of the risks associated with altered fire regimes as a result of the potential introduction of exotic grass species. The provisional weed management plan provided in Appendix O (Section 16) contains little detail of the management practices that will be implemented to reduce the risk of weed infestation. Management plans for species such as Gamba grass exist for other locations in the Northern Territory and should be used to inform management plans prior to finalization of the EIS. Given the near-pristine project environment, and that incursion of invasive species is a key threatening process in the Top End, detailed management plans for specific targeted weed species should be provided in the Supplementary EIS. It is stated here that the KGGP is likely to result in minimal spread of weeds into the pipeline ROW, but there is insufficient detail or evidence provided in the Draft EIS to support this prediction. It is also stated in this summary section that the *"potential impacts to vegetation are expected to be negligible to low and*	Pacific Aluminium acknowledges concerns regarding the assessed level of weed risk. As foreshadowed in the Provisional Weed Management Plan, a more detailed assessment of risk would be undertaken to inform appropriate preventative and management actions using criteria outlined in section 6.2.7 of the EIS Supplement. More detailed planning for weed management (consistent with the Provisional Weed Management Plan and further detailed in section 6.2.7 of the EIS Supplement) will be incorporated into the Construction EMP. Risks associated with the introduction and/or spread of exotic weed species and associated increased fire risks are recognised throughout the Draft EIS (for example on pages 4-10, 8-28, 8-29, Appendix O, page 16-1).

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	therefore considered not significant". This statement is not supported, because the qualifying information provided is limited and of poor quality, and fails to adequately assess the potential impacts of exotic plants and fire As a proposed mitigation action (under minimisation) it is written that weeds within the project area will be "*mapped, recorded, internally reported and monitored*" but not that weeds will be destroyed/removed or actively managed in any way. Targeted weed management plans should delineate exactly how weeds will be removed and disposed of or otherwise treated. The proponent should also commit to routinely monitoring all infrastructure and access tracks for weeds over the life of the project and investment in the long term capacity of local land managers to manage invasive species into the future.ignition. The anticipated effect of mitigation of introduction and spread of exotic species is listed as "*No new introductions or spread of exotic species*" is an unrealistic assumption given the high level of risk of local introductions and exacerbated spread of invasive species associated with the development of extensive infrastructure traversing disturbed and non-disturbed landscapes, and the exacerbation of such risk where appropriate management plans have not yet been demonstrated. Here is it stated as an outcome of the KPPG Project that there will be *"no spread of weeds, or introduction of feral animals in to the pipeline ROW"*, however there is significant potential for spread of aquatic weeds and also for introduction of feral animals into the pipeline ROW.	
7-34 Northern Land Council	Under subheading *'Translocation of fish, pests and/or pathogens'* the Draft EIS stipulates as a management measure to minimise risk of translocation of	The specific locations of washdown facilities will be determined based on the outcomes of weed surveys and risk assessment to be conducted in consultation

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	species, pests and disease into watercourses *"Collecting and disposing of washdown wastewater in a manner approved by the regulatory authority"* (pg 9-26). Further detail on how and where this washdown will be conducted, specific washdown wastewater removal S.O.P should be developed, implemented and included in the EIS.	with the DLRM and landholders (see section 6.2.7 of this EIS Supplement).
7-35 Northern Land Council	The opening statements regarding contemporary changes in fire regime and traditional Aboriginal land management practices need to be qualified with references. Additionally the potential for aggressive invasive grass species with high fuel loads to establish themselves in the project area and become a vector for higher intensity and/or higher frequency fires may be underestimated.	References in support of statements in section 8.3.3 of the Draft EIS (Fire ignition – increased risk of fire, Chapter 8: Vegetation) indicating the substantial impact that changes in fire regime in the project area, pre-European settlement compared to recent history include the following: Bowman and Panton (1993); Bowman *et al.* (2001); Edwards *et al.* (2009); Russell-Smith (2002); Russell-Smith *et al.* (2003). References relating to the potential for aggressive invasive weed species (primarily grasses) to generate more frequent and/or more intense fires, and the impact of these on biodiversity and other environmental variables include the following: Brooks *et al.* (2010); Ferdinands *et al.* (2005); Flores *et al.* (2005); Setterfield *et al.* (2010). Full references to above can be found in the References section of the EIS Supplement. See section 8 (Vegetation) and the Provisional Vegetation, Weed and Rehabilitation Management Plans (Appendix O) contained in the Draft EIS and section 6.2.7 of this EIS Supplement regarding, the recognition that introduction and spread of grassy weeds with potential to increase fire fuel loads, is a key

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		potential impact to be mitigated during construction and operational phases of the project.
7-36 Northern Land Council	Pacific Aluminium should commit to decision making protocols that include further consultation with traditional owners to ensure that all ancillary infrastructure and access tracks are appropriately located.	Pacific Aluminium has committed to ongoing engagement with Aboriginal traditional owners throughout the life of the KGGP project (see section 1.10 of the Draft EIS). Since the preparation of the draft EIS specific engagement has occurred with Aboriginal traditional owners in respect of the location of ancillary infrastructure and access tracks (see section 6.2.11 of this EIS Supplement).
7-37 Northern Land Council	Very little detail regarding access tracks is provided in the Draft EIS, it is not clear exactly which access cleared during the construction phase would remain permanent and which would be temporary. This is a considerable omission given the remoteness of much of the pipeline route and the considerable distances that many of the tracks will be required to traverse. It is also not clear whether the pipeline route itself would remain as a maintenance track or if it would be rehabilitated with native grasses.	See section 6.2.6 of this EIS Supplement providing additional detail on access tracks. The location of access tracks and the identification of those required during the operational phase of the KGGP project is the subject of detailed design. As per section 2.6.11, 2.7.3 and 2.8.4 of the Draft EIS, a maintenance track would be retained along the ROW.
7-38 Northern Land Council	Appendix U discusses the protocols used for selection of sites (e.g. access roads, camps) and Appendix V provides details topographic maps outlining the pipeline route and locations of major infrastructure components. Potential locations for temporary and permanent access tracks are not shown in either document. Instead, Pacific Aluminium states it intends to determine specific locations for some ancillary infrastructure (e.g. construction camps) and other works (e.g. access tracks, laydown areas, machinery and vehicular parking, borrow pits) during the detailed design phase. Consultations with traditional owners should take place at this time. Uninformed decisions may lead to the determination of unsuitable locations for access roads and infrastructure; for	See response to comment 7-37. The location of access tracks is the subject of extensive consultation with landholders. In the case of Aboriginal freehold lands, consultation with Aboriginal traditional owners has commenced through the NLC and will continue through the design phase.

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	example concerns were raised in 2004 with respect to a proposed camp near Wonga Creek (Camp 5), and the impacts the camp may have on nearby waterholes and the wider catchment.	
7-39 Northern Land Council	It is stated *“traffic would be managed within the project area though a Traffic Management Plan”* (pg.8-32). It is difficult to foresee how access to permanent tracks could practically be restricted or managed over the long-term; access by members of the public and local people for recreational purposes is likely. The incursion of new roads into previously inaccessible areas presents a gamut of potential environmental impacts, including intrusion on culturally significant sites, weed dispersal, and fire ignition. Management issues relating to the control of entry onto Aboriginal Land Trust land may also arise. A greater focus on controlling 4 wheel drive enthusiasts, tourists and even traditional Aboriginal owners, particularly where new access tracks are constructed, is required to mitigate such risks. These measures are absent from, but should be integrated with the Cultural Heritage Management Plan (Appendix O; Section 10) and provided in the Supplementary EIS.	As indicated in Section 14.1.3 of the Draft EIS, the proponent is consulting with the NLC, on behalf of Aboriginal traditional owners, to negotiate acceptable approaches to minimise the risk of access by unauthorised persons onto culturally significant sites (including 4WD enthusiasts, tourists and traditional Aboriginal owners from other lands; p 14-2). Negotiations and an approved Traffic Management Plan could, for example, involve installation of gates or other barriers at high risk areas, e.g. sites close to areas with significant recreational 4WD use. The numerous waterways crossed by the ROW would also comprise a natural barrier to such unauthorised use. The Draft EIS commits to using existing access tracks as much as possible, and rehabilitating all but those required for inspection and maintenance during the operational phase of the project. No permanent bridges, culverts or other structures will be installed across watercourses that could subsequently facilitate access into restricted areas (Table 14-1: Potential impacts and mitigation outcomes for land tenure and use, in Draft EIS).
7-40 Northern Land Council	Given that Australia is a signatory country it may also be appropriate to include Convention on International Trade in Endangered Species (CITES) Appendix 1 species (threatened with extinction), as species to be given special consideration in the Draft EIS, if any such species are known to occur within the KGGP Project area.	The focus of the EIS is on threatened species identified and formally protected under the relevant provisions of the TPWC Act and the EPBC Act as this legislation implements relevant international obligations domestically. There are no aspects of the KGGP project that give rise to international trade in wildlife.

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7-41 Northern Land Council	The Ecoz field survey methodology included only 10 survey locations throughout the entire KPPG Project area and conducted all of these most recent surveys only during November 2012. Given the size of the project area, seasonal variations in fauna life history and the variety of habitats encountered in that region, this generates insufficiently representative data to apply to the entire KPPG Project. The survey sample size should include additional locations and a greater variety of relevant habitat and landscape types. Furthermore sites should be resurveyed six months later to account for seasonal variability in species representation.	This work was undertaken by Eco Logical Australia fauna experts (rather than EcOz) and built on the earlier survey work conducted by EcOz in 2003/04. Ten sites were surveyed using observation, remote cameras and hair tubes. Additional sites were targeted for bird surveys and general observations or spotlighting in the Beswick region. Sites were targeted to locations that would hold water late in the dry season, be attractive to wildlife and maximise the number and diversity of faunal species encountered, particularly for target species (listed threatened mammals and birds). Additional survey sites were included in the survey of the area to the north of the Mitchell Ranges (see Chapter 4of this EIS Supplement). Survey results are considered adequately representative. Approximately 84% of the ROW is characterised by the same type of vegetation community: forests, woodlands and mostly open woodlands dominated by Eucalypts and Bloodwoods (*Corymbia* species).. The targeted listed of species do not in general display striking seasonal differences in distribution and abundance. For these reasons, the November 2012 survey is considered adequately representative for assessing potential impacts from the project.
7-42 Northern Land Council	Impacts from the noise of construction works and also operational works (gas release, maintenance works, etc.) should be included in the *Potential impacts of construction and operation* section of the EIS. Another potential impact that should be listed among the dot points of Pg.9-10 is the '*Migration of individual fauna away from the project area',* due to the potential impacts on the local and	The potential impact of noise on fauna has been included in Chapter 10 and 14 (section 14.4.3) of the Draft EIS and the Provisional Terrestrial and Aquatic Fauna and Habitat Management Plan of the EMP (Appendix O, page 6-1). The likelihood of populations of EPBC listed species occurring within the project

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	regional population ecology of some species represents. EPBC or CITES listed species are likely to be more sensitive to such impacts; as such these species warrant more intensive and on-going research. Further effort should be made to identify populations of EPBC or CITES listed species within the project area, to monitor potential impacts and where appropriate to develop a species/population specific management plans and including investments in offsetting impacts. Such plans should include inductions for project managers and personnel on impact mitigation measures, how to identify and avoid negative effects upon targeted species and their habitat throughout operations. The risk matrix included in the Draft EIS is insufficient for this purpose.	area was assessed on the basis of desktop review, consultation with experts and Aboriginal traditional owners and fauna surveys conducted in 2004, 2012 and 2013. The information generated by this work is considered sufficient for the purposes of environmental impact assessment. The Gouldian Finch population at the western end of the pipeline is the only population of an EPBC listed species that has been assessed as requiring a specific management plan, monitoring program and offset investment. These commitments are outlined in the Draft EIS and this supplement. The EMP's Provisional Terrestrial and Aquatic Fauna and Habitat Management Plan indicates (in Table 6-2, page 6-7) that all site personnel will be subject to an environmental induction and training, incorporating information on significant species likely to occur in the project area and what to do if sighted and/or encountered.
7-43 Northern Land Council	While the Draft EIS stipulates measures to mitigate mortality of individuals by capture in trench, a policy or response plan for injured fauna has not been stipulated.	See section 6.2.10 and Appendix D of this EIS Supplement.
7-44 Northern Land Council	This section of the EIS should consider potential operative trade-offs, and present decision-making protocols. For example, geology, access, engineering or other factors may compromise the use of HDD to cross a major watercourse which is flowing; by what method will decision-making occur during pipeline construction?	See section 6.2.3 of this EIS Supplement in respect of risk assessment and adaptive management processes to be employed in respect of watercourse crossing.
7-45 Northern Land Council	The Draft EIS states that Cane Toads are the key feral fauna species known from the Project area (pg.9-27) but fails to qualify why or how this status was	The statement on page 9-27 was a qualitative statement and it is acknowledged that other feral animal species present in the region such as Buffalo also affect

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	determined. Other exotic species, for example buffalo, have significant impacts on aquatic fauna. It is also written that the distribution of Cane Toads *"is unlikely to be exacerbated by the KGGP"*. However given that several introduced species are relatively recent arrivals to the Top End, their populations are not likely to be at carrying capacity in the KGGP Project area, and it may be reasonable to assume that clearing vegetation and providing increased access to standing water will facilitate the intrusion and growth of feral fauna populations in the Project and neighbouring areas.	aquatic habitats and could equally be perceived as having a more significant impact. The comment indicates that the project will provide increased access to standing water. Outside of the use of water storage ponds (see section 6.2.4 in this EIS Supplement) the project will not increase standing water. This increase will be localised and temporary, being limited to the construction phase. No increase in standing water is envisaged to result from operation of the KGGP project.
7-46 Northern Land Council	It is also stated here that *"In-stream habitat [will be] restored to original condition prior to onset of following wet season"*, this is unrealistic given that even if the same species composition is achieved it is impossible to regrow vegetation to the original condition within 6 months. This point should be rewritten to reflect this reality.	The reference to in-stream habitat should have been made in respect to in-stream substrate. Reinstatement of the watercourse profile following open trenching will restore the substrate to a condition where in-stream habitat can re-establish (see additional detail on reinstatement, rehabilitation and monitoring in section 6.2.3 of this EIS Supplement). It is acknowledged however that this aspect is likely to require a period longer than the onset of the following wet season.
7-47 Northern Land Council	Risk assessment tables (Tables 10-6, 10-9, 10-12, 10-16, 10-19, 10-22, 10-25, 10-28, 10-32, 10-36 and 10-41) provided for each of the species of national environmental significance are not complete. The tabulated information provides only an assessment of the magnitude of residual impacts following mitigation and does not make clear the potential of impacts prior. The tables should be corrected to demonstrate the full magnitude of the unmitigated risk for each of these species.	These tables draw attention to the likely residual impact for each species as the concluded outcome of the assessment. The potential pre-mitigation impacts are discussed in the sections preceding the tables and briefly summarised in the first column of each table. Pre and post mitigation risks are also dealt with more generally in the over-arching risks assessment contained in the Draft EIS (Chapter 5).

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7-48 Northern Land Council	In discussing implications of small mammal species decline in the area, Pacific Aluminium indicates that the potential for the KGGP project to affect these species (identified in Table 10-2) is very low. In fact species in decline are particularly vulnerable to impacts and increased adherence to protection of their habitat or provision of offsets should apply.	The small mammal decline experienced across Northern Australia decreases the likelihood that individual animals will occur in the habitats affected by the KGGP project. It is however acknowledged that these species may be present (although not detected during survey) and if so the significance of any interaction with the project would be higher, as suggested by the comment. For this reason the Draft EIS does not dismiss potential impacts on these species and focuses on appropriate mitigation and management measures such as use of HDD, rehabilitation and strategies for avoiding spread of weeds that will apply generally to these and other more common species. These are expanded upon in this EIS Supplement. Offsets are not considered warranted as significant residual impacts are not expected (see response to 7-49 below).
7-49 Northern Land Council	Even though offsets may not be required under legislation, every effort should be made to encourage an increase in the populations of these mammals. The potential for developing offsets for these species should be revisited, as has been done for the Gouldian Finch (refer to Chapter 17, Section 17.7.1), and included in Supplementary EIS documents.	See sections 5.5 to 5.9 of this EIS Supplement which clarifies likely formal offset requirements for particular Matters of NES. Commonwealth Government policy only requires consideration of offsets where there is likely to be a significant residual impact, after mitigation. The proposed offset project for the Gouldian Finch to improve habitat quality through better fire management is however likely to improve habitat quality for other species, in the manner suggested by the comment.
7-50 Northern Land Council	The reasoning provided for removing this species from consideration is not necessarily supported by scientific fact, considering that 45 survey records could not be attributed to either of the two taxons (*A micricarpa* or *A australasica*). This implies that anywhere between 0 and 45 of these records could relate to the protected *A. australasica* species. As suggested in Section 3.9 of this review, additional survey work along the KGGP route should be undertaken to determine	The reference cited here, from page 10-22 (Section 10.4.2, Australian Arenga Palm, in Chapter 10: Matters of National Environmental Significance), indicates that *A. microcarpa* was found at 23 localities based on collections and 45 survey records. The comment from NLC has misinterpreted the paragraphs that indicated that in the past there was taxonomic uncertainty for these data; however, the uncertainty is historic, and there is no longer any uncertainty: *A.*

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	definitively if the *A. australasica* species is actually present.	*australasica* does not occur in the NT, so those 45 survey records are now known to be *A. microcarpa*.
7-51 Northern Land Council	Pacific Aluminium indicates that the proposed pipeline corridor has no potential to impact the habitat of the adult Fresh Water Sawfish because it does not cross the lower (saline) reaches of estuaries or open coast. This is contradicted by Appendix Q, Table 1, which indicates that adults may occur at Crossing 1 in the estuarine reaches of the Latram River. There is therefore potential to impact the habitat and populations of the sawfish. This apparent contradiction should be rectified.	See section 6.2.4 of this EIS Supplement providing a specific Risk Assessment and Adaptive Management Strategy in respect of watercourse crossings that may provide potential habitat for the Freshwater Sawfish.
7-52 Northern Land Council	The Wonga Creek catchment is part of the Dhimurru IPA and contains important cultural and recreational sites. In 2004, concerns were raised about the level of impact that construction camp 5 might have on the environmental and cultural values of the catchment and waterholes in the nearby vicinity (pg.11-8). A more focused risk assessment related to this camp should be undertaken in consultation with traditional Aboriginal owners to ensure that the camp is located at the most appropriate site.	Pacific Aluminium acknowledges the Wonga Creek catchment area is part of the Dhimurru IPA and is committed to working closely with Dhimurru to ensure both cultural and recreational sites, where potentially impacted, are well managed. KGGP project members from design, environment and construction have completed field trips with the NLC during July and August 2013. During these field trips the Aboriginal traditional owners were able to advise the project team of cultural preferences for ancillary site locations. Camp 5 was originally proposed to be located close to Wonga Creek. After further assessment by KGGP project the camp location has been relocated and is now approximately 30 kilometres from Wonga Creek.
7-53 Northern Land Council	Introduction and spread of exotic fauna and flora species into areas of high conservation value (e.g. IPAs) is a major concern of traditional owners. This issue has been discussed via comments on Chapter 8. Here Pacific Aluminium proposes to use access controls to manage worker visitation to sites and control	The proposed weed risk assessment will inform appropriate preventative and management actions using a range of criteria including the conservation, cultural and heritage values of surrounding land. (See section 6.2.7 of the EIS Supplement for more information).

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	the spread of weeds, but these controls will not necessarily apply to the general public.	
7-54 Northern Land Council	Chapter 12 focuses largely on modelled impacts, with little reliance on direct monitoring of air quality.	Air quality emissions from the operation of the KGGP pipeline and facilities are predicted to be low and are not considered to present a risk to human health. Therefore ongoing routine air quality monitoring during operation is not proposed. Design of the facilities (including main line valves and compressor station) and specification of components shall ensure air quality emissions are as low as practicable. For example the use of low NOx emissions technology has been specified for the gas turbine of the compressor station. The operational plan for the pipeline and facilities will include routine maintenance observations and fugitive leak testing. Should fugitive leaks be detected they will be resolved as soon as possible in accordance with the operations and maintenance plan. As outlined in Chapter 12 of the Draft EIS, minor fugitive emissions are possible from routine operation and maintenance operations of the pipeline and facilities. The potential pollutants of concern (PPOC) identified for the operational phase of the project are: • Oxides of nitrogen (NOX as nitrogen dioxide, NO_2); • Carbon monoxide (CO); and • Photochemical smog (as evidenced by ozone, O_3). Particulates including Airborne particulate matter with an aerodynamic equivalent diameter (AED) of 10 µm or less (PM10) and Deposited Total Suspended Particulates (TSP) were not identified as potential pollutants of

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		concern during the operational phase including at the compression station and hence routine monitoring is not required. As outlined in Chapter 12 of the Draft EIS the exhaust from the gas turbine of the compressor station has been identified as the primary source of air pollutant emissions. 'The results of the modelling of predicted ground level concentrations for air pollutant emissions from the compressor station are summarised in Table 12-2 of the Draft EIS. The maximum predicted ground level concentrations for carbon monoxide, nitrogen dioxide and ozone were well below NEPM assessment criteria'. Taking into account, both the low impacts and the large distances to the nearest human health receptor, the operation of the pipeline is considered to present minimal risk to human health.
7-56 Northern Land Council	The Draft EIS does not adequately address the likely impact of dust emissions on local communities and outstations.	This matter is addressed in section 12.2 of the Draft EIS and the Provisional Air Quality Management Plan (section 8, Appendix O). With the identified mitigation measures in place and further development of the management plan during the design phase, it is considered that the dust emissions can be managed within acceptable limits.
7-57 Northern Land Council	There is no commitment to monitoring and control of emissions from vehicles, mobile equipment exhausts and combustion emission from power generation at camps.	See response to comment 7-54.
7-58 Northern Land Council	The absence of direct measurements of air quality and particulates along the KGGP route meant that modelling was employed to provide predictive values (pg.12-2). While this is acceptable for the construction phase, other than periodic leak surveys to detect fugitive gas releases, there is no detail provided	See response to comment 7-54.

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	with respect to routine air quality and particulate monitoring that would be required during operations.	
7-59 Northern Land Council	A detailed plan to determine the levels of pollutants being released and the suitability of the mitigation measures for reducing them should be prepared and integrated with the Provisional Air Quality Monitoring Plan provided in Appendix O (Section 8) and included in the Supplementary EIS.	See response to comment 7-54.
7-60 Northern Land Council	Pacific Aluminium states that *'if the extension to the EEO Act is implemented, then a Greenhouse Gas Emission Assessment Plan for the pipeline facility will need to be developed detailing how the assessment at the design stage will be undertaken.'* An indication of when this plan will be produced should be provided in the Supplementary EIS.	This requirement will be reviewed once national policy on carbon is clarified.
7-61 Northern Land Council	Pacific Aluminium indicates that sacred site surveys were undertaken in 2004 for most of the TTP route, but the AAPA certificates have since expired. Pacific Aluminium also advises that Archaeological and sacred site surveys are still required on two areas of the route. It is anticipated that these surveys will be completed in 2013. These surveys should be undertaken in the presence of Traditional Aboriginal Owners. Information collected during the site surveys and any subsequent work required for the new AAPA certificates should be integrated (where appropriate) into the Supplementary EIS and the Cultural Heritage Management Plan.	Pacific Aluminium acknowledge the importance of obtaining updated information in relation to scare sites and submitted an application in accordance with the sacred sites legislation to engaged AAPA in March 2013 to conduct surveys for the KGGP route and ancillary infrastructure. AAPA is working closely with the NLC to share data and information to complete the assessment for Pacific Aluminium. AAPA is scheduled to complete the field work by September and it is anticipated certificates will be issued by November 3013.
7-62 Northern Land Council	Appendix J contains a summary of the archaeological and historical research that has already been undertaken along the pipeline route. The amount and type of material that can be provided are constrained by requests from Traditional	Archaeological surveys have been completed for the majority of the pipeline ROW and commitments made for pre-clearance survey of the remaining unsurveyed sections of the ROW and other areas proposed to be disturbed (for

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	Aboriginal Owners and legislation, so the Appendix appears incomplete. This does not represent a concern provided that cultural information that is not included in the EIS and the Appendix has been collected and rests with the appropriate people.	example construction camps and access tracks), once their locations have been settled through the design phase. Surveys will assist in fulfilling obligations under the *Heritage Act* relating to the protection of archaeological sites and material and requirements for consent to disturb (if required). The implementation of the remaining surveys and the response in respect of mitigation or consent processes under the *Heritage Act* will be undertaken within the framework of the Cultural Heritage Management Plan and in consultation with the NLC and relevant Aboriginal traditional owners (see section 13.2.3 of the Draft EIS).
7-63 Northern Land Council	It is of concern that the predominant use of FIFO workers and procurement of materials from distant cities means that the communities will bear the brunt of the social risk, while the more immediate economic gains from the construction phase will effectively be transferred out of the region. While little can be done about this transfer of wealth, every effort should be put into replacing the maximum number of FIFO employees required by locally engaged employees, particularly from nearby communities.	Since the submission of the Draft EIS and further ongoing consultations with communities, Pacific Aluminium has identified local employment and procurement opportunities. Pacific Aluminium is working closely with organisations to ensure local businesses and Aboriginal companies have access to tender for appropriate work packages. The predominant use of FIFO workers will be the specialised workforce required to construct a pipeline. Pacific Aluminium acknowledges that whilst the construction of the KGGP requires a specialised workforce and materials, the broader positive contribution is the continuation of the Gove alumina refinery which is a large economic contributor to North East Arnhem Land.
7-64 Northern Land Council	Modelling provided in Appendix A indicates that over the period 2013 – 2036, the project will increase the real economic output of the region by a cumulative amount in excess of $2.4 billion. However, the EIS does not provide an assessment of the sensitivity of this increase to fluctuations the Australian dollar or in alumina and gas prices. This analysis should be undertaken and provided	The modelling was undertaken on assumptions and is a standard methodology for this purpose. The methodology would have considered long range price assumptions.

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	in the Supplementary EIS to demonstrate whether or not the operations would remain viable across the whole of the period to 2036 or if small changes in key price variables are likely to trigger early closure.	
7-65 Northern Land Council	Pacific Aluminium offers to develop a Local Employment Plan (Appendix M pg.17) which will include a hierarchy of employment preferences to ensure that relevant opportunities are afforded to local and Aboriginal people. This plan should be developed in consultation with local Aboriginal business organisations and other service providers and included in the Supplementary EIS.	The Local Employment Plan will be developed with full engagement of local communities and organisations. The Plan will be developed over timelines that extend beyond the period of EIS development and has therefore not been included in this EIS Supplement. Pacific Aluminium is currently working with the NLC to identify and support job opportunities for traditional owners along the pipeline route. These discussions will continue for the duration of the project.
7-66 Northern Land Council	One of the most significant concerns raised during SIA consultations was the potential for an increase in alcohol and substance abuse, particularly in remote communities. Given the level of concern raised and Pacific Aluminium's commitment to a zero tolerance policy (Appendix A of Appendix O p 10) the plans for wet mess facilities entertained by the Social Impact Management Plan (Appendix 1 of Appendix M, Table 8-4) should be reconsidered.	Pacific Aluminium is committed to a zero tolerance policy and a Code of Conduct for the workforce will be implemented. Pacific Aluminium is considering the potential impacts of wet mess facilities in the temporary camp locations. Pacific Aluminium understands alcohol restrictions are in place throughout various locations in the Northern Territory and acknowledges the support and consent of Traditional Owners is required to submit a permit for temporary wet mess facilities. Pacific Aluminium is giving further consideration to the use of wet mess facilities for the project.
7-67 Northern Land Council	The Social Impact Management Plan (SIMP) is restricted in time and scope as it focuses on management actions for the construction phase and does not fully consider the longer-term or cumulative impacts that might emanate from	See section 6.2.11 of the EIS Supplement.

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	successful completion of the project. This is manifest through a number of issues outlined below. Appendix M (pg.18) and the SIMP consider impacts only on the major communities spread along the Central Arnhem road. Flow-on impacts and benefits to numerous smaller, permanently populated aboriginal communities (outstations) are not considered. The existence of these communities should be acknowledged in the SIMP (and the EIS) and an assessment of potential flow-on benefits and impacts provided in the Supplementary EIS. The SIMP (Section 9.1, pg.25) indicates that a Community and Stakeholder Engagement Plan (CSEP) has been developed for the project, but also provides language later that implies it is still to be developed (pg.25, 26 and Appendix O, Section 2.4, pg.2). The plan does not appear to be clearly identified within the EIS, so it is assumed it is not yet written. This should be clarified or the CSEP written and provided in the Supplementary EIS.	
7-68 Northern Land Council	Pacific Aluminium indicates that its existing Community Observation and Feedback Management Procedure will be applied. This document has not been provided and should be provided in the Supplementary EIS.	This document has been supplied to the NLC. The document is considered an internal document to lodge, investigate and respond to community observations. A summary of the observations will be made available in annual reporting. Pacific Aluminium has committed to engage a land liaison officer within the NLC and will work collaboratively to resolve any community observations throughout the project.
7-69 Northern Land Council	Blasting may be required along the KGGP route near Beswick or in the Mitchell Ranges. This will occur during the dry season at times when traditional owners will be more mobile. Although the potential impacts associated with noise from blasting have been assessed, the treatment of other physical safety issues is	Comprehensive safety planning for blasting (if this technique is required) will include full discussion with the NLC to ensure appropriate communication of activities and control measures to affected landholders.

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	inadequate. The likelihood of people undertaking traditional or cultural pursuits within blasting areas and the risks they face has not been addressed. There appears to be no plan for management or control of access to blasting areas; or for communicating times, dates and locations to local communities. Mitigation measures for specific issues such as flying shards of rock have not been developed.	
7-70 Northern Land Council	The area of land directly impacted is only just over 2000 ha, but the extent of the risk the KGGP poses is a lot higher as its route crosses a number of waterways that pass through Arnhem Land. These and the ROW are two significant vectors that may help promulgate weeds and exotic fauna species through large swathes of pristine countryside over a period up to 50 years.	The proposed weed risk assessment will inform appropriate preventative and management actions using a range of criteria including the location, topography and proximity to water bodies (See section 6.2.7 of the EIS Supplement for more information).
7-71 Northern Land Council	The EIS is complex because the KGGP crosses a number of different environmental types along its 600km route. For the most part, it makes adequate use of a large amount of information collected in two stages – during the 2003-04 EIS for the TTP route; and in 2012 when the pipeline project was reactivated. Where data was deficient, the KGGP EIS relies on modelling to 'predict' the extent of some impacts. Where models have been used, the assessment of associated risks would benefit greatly from direct monitoring and provision of hard, field-based data.	Additional survey information has been provided in this EIS Supplement. See response to comment 7-54 in respect of the need for monitoring in respect of modelled air emissions. Where appropriate, monitoring is proposed through the EMP.
7-72 Northern Land Council	The EIS does not address potential cumulative effects. Although there are no other major projects being developed along the route to consider, risks associated with some parts of the project may be exacerbated if they are placed	The potential cumulative impacts of future developments unrelated to the KGGP project, in the project area, are beyond the scope of this environmental impact assessment. Regarding placement of various components of the project (e.g.

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	in inappropriate locations (e.g. wastes being placed in areas of high soil porosity and groundwater mobility). As expected, most of the assessment focuses on the construction phase of the program. This has led to a decreased focus on the extent that impacts may accumulate over time as the project progresses through its operational and into its decommissioning phase.	wastes), the draft EIS explains that decisions on location will be guided by criteria to protect environmental values. The Draft EIS addresses operational impacts where relevant (for example air emissions from the compressor station).
7-73 Northern Land Council	Some parts of EIS rely upon information that is to be acquired during engineering design, but this phase has yet to be completed. Consequently, the EIS has been released prematurely and NLC has identified some significant gaps in the information provided.	Release of the EIS is not considered 'premature'. The NT EPA and DSEWPaC EIA processes acknowledge that major projects (such as the KGGP project) will not, in general, have all design and engineering details settled before conclusion of the assessment. Where particular details of design, engineering, operation, etc. are not available at the time of review, approvals will generally be contingent on provision of these details prior to any activity with potentially significant environmental impacts and/or conditions imposed to ensure that environmental impacts related to these details will be manageable and acceptable.
7-74 Northern Land Council	All of the Provisional Management Plans suffer in quality through a lack of detail. While it is understood that a final plan could not be provided *in some instances*, a number of the plans (or parts of the plans) deal with matters that are already quite well known and this information should have been included. Examples include the Traffic Management Plan and the Weed Management Plan (where management strategies for species such as Gamba grass) are well developed for other locations. Other plans need to be reconsidered because they rely on qualitative or descriptive assessment as performance indicators, instead of direct scientific measures (e.g. of chemical species that affect water and air quality). These include plans for management of:	As indicated in the EIS Guidelines, issued by the NT EPA (Draft EIS, Appendix P), the EMP (and its sub-plans) should be strategic, "describing a framework for environmental management of the project, with as much detail as is practicable." Because the majority of the project area is on Aboriginal land, the Draft EIS acknowledges the importance of developing plans that are consistent with existing plans, implemented largely by indigenous ranger groups, and maximise the opportunity for actions to be implemented by rangers. The provisional management plans are consistent with NT EPA advice and will be further developed in consultation with the NLC, Dhimurru Aboriginal Corporation and Laynhapuy Homelands Association Incorporated, pastoralists and other stakeholders, and in line with NT EPA Guidelines indicating that "The EMP

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	• Hydrology and Water Quality; • Air Quality; and • Greenhouse Gas Emissions Management; Where direct quality control is required for the final management plan, Pacific Aluminium should indicate this in the Supplementary EIS and in the text of the revised plans.	would continue to be developed and refined following the conclusion of the assessment process, taking into consideration the proposed timing of development activities, comments on the EIS and incorporating the Environmental Assessment Report recommendations and conclusions," in addition to any conditions attached to approvals that specify environmental management requirements. See section 6.2.7 of the EIS Supplement for more information regarding detailed weed management planning. In relation to the recommendation that direct scientific measures be incorporated into respective management plans, this has already been accommodated in commitments to meet environmental standards and licence conditions, e.g. discharge of hydrotest water is contingent upon water quality meeting the limits set out in Table 7-7 of the draft EIS, and water quality testing will have to be done to demonstrate compliance.
8-1 NT Department of Primary Industry and Fisheries	This Department's preference is that all wet water crossings be constructed using horizontal direct drilling in order to minimise the impacts on aquatic fauna and vegetation. It is appropriate for dry crossings to be constructed by open trenching, provided that bankside rehabilitation is also conducted. The contractor's definition of 'in flow" requires examination to ensure these guidelines are adhered to and impacts on the riparian environment and dependent ecosystems are minimised.	See section 6.2.3 of this EIS Supplement.

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9-1 Dhimurru Aboriginal Corporation	Indigenous Protected Areas are not areas where traditional owners have entered into an agreement with the Australian Government per se but rather they are areas that traditional owners have dedicated to nature conservation in accordance with IUCN principals. The Dhimurru IPA is an area that traditional owners have dedicated and committed to manage in accordance with Category 5 protected area requirements. The Commonwealth has recognised the terrestrial component of the Dhimurru IPA and included the area as part of Australia's National Reserve Estate recognising the area's conservation significance. The commitment to consultation with Dhimurru and Yirralka in the development of management plans where the pipeline and the IPA's intersect is noted and supported.	The IPA arrangements and support for ongoing consultation with Dhimurru and Yirralka are noted.
9-2 Dhimurru Aboriginal Corporation	The Dhimurru IPA was extended by traditional owners on April 10 primarily to include a collaboratively managed sea country zone. The extension has been endorsed by the Northern Land Council on traditional owners behalf, stakeholders, the Commonwealth and the Northern Territory Governments. The Dhimurru IPA now extends 40km seaward and has been extended to follow the watershed on its western perimeter. The Dhimurru IPA now covers approximately 550, 000 ha. Shape files are available if required. We note that this extension has implications for shipping but does not materially change the terrestrial observations of the EIS.	At the time of publication of the Draft EIS, the extension of the Dhimurru IPA had not yet been formally announced; therefore, the Draft EIS was limited to using the existing map and boundaries of the IPA prior to the expansion. Extension of the IPA has no implications for the potential environmental impacts discussed in the draft EIS or the values for which the Dhimurru IPA was declared or extended, as the increase in shipping for this project comprises only up to two shipments expected to deliver pipe to the Port of Gove.
9-3 Dhimurru Aboriginal Corporation	We note that the "Wonga" Construction Camp will be located within the Dhimurru IPA. We request that we be included in site selection and are fully briefed on site establishment and decommissioning including a site visit with those responsible	Ongoing consultation on the siting of construction camps will be undertaken with the NLC, Aboriginal traditional owners and the Dhimurru Aboriginal Corporation. Construction Camp 5 has been relocated.

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	for these activities.	
9-4 Dhimurru Aboriginal Corporation	Criteria for determining the placement of access tracks should include consideration of their effect on ongoing management. Dhimurru is concerned to minimise the number of access tracks likely to be used by the public as a means to gain greater access to areas within the Dhimurru IPA. Consideration will also need to be given to interaction with existing tracks to minimise the requirement for new track creation. Dhimurru would like to be directly consulted by the design team as access track requirements are being formulated.	See section 6.2.6 of this EIS Supplement regarding access track design. Creation of new tracks will be kept to the minimum necessary and options such as temporary bridges are being investigated to further reduce access track requirements. Pacific Aluminium intends to consult Dhimurru Aboriginal Corporation during the design phase when access track requirements will be finalised.
9-5 Dhimurru Aboriginal Corporation	The commitment to consult landholders on rehabilitation actions following construction is noted and Dhimurru assumes it will be included on this basis.	Noted. Pacific Aluminium currently works closely with Dhimurru in relation to rehabilitation at the mining lease in Gove and will continue to consult with land holders during and following construction of the KGGP project. The KGGP project also has made commitments to engage each of the five ranger groups along the pipeline corridor to assist with rehabilitation of the ROW.
9-6 Dhimurru Aboriginal Corporation	Seeding of disturbed areas to maximise stability and reduce weed ingress is supported but consideration also needs to be given to potential increased fire risk post wet season. Stabilisation should involve a range of actions including spreading of cleared vegetation, careful landscaping to minimise concentration of run off, and utilisation of erosion control devices where necessary.	Support for the rehabilitation approach and concern regarding potential increased fire risk is noted. The provisional Soil and Landform Management Plan and Rehabilitation Plan (Draft EIS Appendix , sections 3 and 17) both outline the use of a variety of techniques to facilitate soil stabilisation and explicitly acknowledge the need to take the potential for weed infestation and fire risks into account: 'Poor construction, operation and rehabilitation practices can cause and exacerbate existing rill and gully erosion, lead to sedimentation of waterways,

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		threaten the integrity of infrastructure, and facilitate the colonisation of aggressive weed species which alter habitats and adversely affect fire regimes' (page 3-4). 'As the construction of the project occurs in a region with highly aggressive, wind dispersed weed species and seasonal monsoonal rainfall the potential for weed infestation (and the subsequent impacts of fire associated with weeds) and erosion needs to be managed appropriately. To address both, this Rehabilitation Management Plan proposes to revegetate disturbed areas with a dense cover of appropriate native grasses based on the level of risk and the reasonable expectations of relevant stakeholders. Criteria associated with the risk of erosion, weed infestation, slope, soil type and requirements to establish fauna habitat and protect cultural heritage sites would be developed to identify disturbed areas that require active revegetation with native grasses' (page 17-2).
9-7 Dhimurru Aboriginal Corporation	Dhimurru would like to be consulted directly during access track and borrow pit finalisation in the "detailed design phase". Dhimurru believes the access track arrangements will be of high ongoing management significance.	Pacific Aluminium understands the need to directly consult with landholders and Dhimurru in relation to finalising the access track and borrow pit locations. Pacific Aluminium was able to complete further consultations during the field trips in July and August 2013 and will continue to be guided by the Northern Land Council in relation to final locations which are appropriate from a land use and design perspective.
9-8 Dhimurru Aboriginal Corporation	Impacts on traditional owners access, ongoing management, and recreational access are factors that should be included amongst the matters to be considered in designing access track placement.	See response to comment 9-4. Discussion with Dhimurru Aboriginal Corporation on the design of the access track requirements will address the matters identified in this comment.
9-9 Dhimurru	Dhimurru would like a copy of the "Final Access Road Alignment Summary	Pacific Aluminium agrees with the request and will provide a copy of the 'Final

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Aboriginal Corporation	Report" at least in as much as it relates to the Dhimurru IPA.	Access Road Alignment Summary Report' to Dhimurru Aboriginal Corporation.
9-10 Dhimurru Aboriginal Corporation	The suggestion that watercourses dissecting the track will be sufficient deterrent to limit vehicle movement along the length of the corridor may be valid in the vicinity of major watercourses but is not an assumption that matches our experience of determined 4wd enthusiasts and the hunting fraternity. Dhimurru needs to be involved in planning securing and managing access tracks during and after project completion.	It is acknowledged that dry watercourses crossed by the pipeline ROW or permanent access tracks would not offer a significant deterrent to those who may be determined to gain access. In discussions with Dhimurru Aboriginal Corporation on the design of access track requirements (see response to comment 9-4), Pacific Aluminium will seek mutually agreeable measures to restrict and manage access, consistent with landholder requirements and the management objectives of the Dhimurru IPA.
9-11 Dhimurru Aboriginal Corporation	Technically the statement "The Dhimurru IPA was declared by the Dhimurru Land Management Aboriginal Corporation" is not correct. The declaration was made by traditional owners as defined by the Aboriginal Land Rights Act (NT) 1976. A separate agreement under section 73 of the NT Parks and Wildlife Act identifies Dhimurru Aboriginal Corporation as the traditional owner's management agency.	The correction is noted.
9-12 Dhimurru Aboriginal Corporation	For the sake of clarity Dhimurru Aboriginal Corporation should be referred to as Dhimurru Aboriginal Corporation and references to Dhimurru by its earlier name should be qualified.	The Draft EIS included one incorrect reference to the former Dhimurru Land Management Aboriginal Corporation (page 11-2, Chapter 11: Parks, Reserves and Areas of High Conservation Value); however, the remainder of this Chapter used the current recommended name. References in the Supplement are current and correct.

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9-13 Dhimurru Aboriginal Corporation	See comments at ref.2 regarding the recent inclusion of additional sea country within the Dhimurru IPA and the extension of its western boundary to include water catchment.	This comment is noted. See response to comment 9-2.
9-14 Dhimurru Aboriginal Corporation	It should be noted that it is the terrestrial component of the Dhimurru IPA is part of Australia's National Reserve Estate.	This comment and the distinction between the terrestrial and marine components of the IPA, is noted.
9-15 Dhimurru Aboriginal Corporation	The reference to Perennial Mission Grass as the "weed species posing the greatest threat" should be qualified to clarify this as being the weed species posing the greatest threat that is "currently extant".	This comment is acknowledged. See section 6.2.7 of the EIS Supplement for additional detail on weed management arrangements.
9-16 Dhimurru Aboriginal Corporation	Of the key concerns to Dhimurru traffic management and its potential impact on the both the safety and ease of transit for its personal and members of the public accessing recreation areas within the Dhimurru IPA should be added.	This concern is noted and will be taken up in further discussions with Dhimurru Aboriginal Corporation. See Appendix O of the Draft EIS (Provisional Traffic Management Plan).
9-17 Dhimurru Aboriginal Corporation	Dhimurru notes the commitments to enabling and facilitating effective communication and consultation between the proponent and Dhimurru and looks forward to actioning in conjunction with the proponent.	The support for ongoing communication and consultation is noted and will be implemented throughout the project.
9-18 Dhimurru Aboriginal Corporation	Dhimurru requests a site visit involving traditional owners and site custodians for Crystal Spring together with Dhimurru staff to inspect and discuss the specifically identified point where the pipeline will intersect Wonga Creek ahead of any works commencing.	Pacific Aluminium acknowledges the significance of Wonga Creek and will work collaboratively with the Aboriginal traditional owners, custodians and Dhimurru Aboriginal Corporation during pre-construction and construction.
9-19 Dhimurru Aboriginal	Dhimurru would appreciate the opportunity to discuss in detail potential recreational access requirements of the construction crew both with a view to	All employees will complete cultural awareness training and Pacific Aluminium can include briefings about the importance of Indigenous Protection Areas

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Corporation	ensuring possibilities are well understood and that management requirements are identified and in place.	including any recreational areas. Due to the rotation rosters, there will be limited opportunity for employees to conduct recreational activities. The employees will be transported from the camp sites to the designated work location and return each day. Transportation will be by bus to minimise the use of vehicles.
9-20 Dhimurru Aboriginal Corporation	Please refer comments at reference ref. 11 regarding access track planning, implementation, rehabilitation, and ongoing maintenance. Dhimurru has identified access track management as one of the most significant ongoing management issues arising from the project.	See response to comment 9-4. Additional detail on access tracks is provided in section 6.2.6 of the EIS Supplement.
9-21 Dhimurru Aboriginal Corporation	Dhimurru strongly supports measures to effectively prevent the spread of weeds including wash down and inspection points quarantining sections of the corridor depending on weed survey information and the identification of critical control points.	Support noted. See section 6.2.7 of this EIS Supplement for additional details on weed management.
9-22 Dhimurru Aboriginal Corporation	Actions proposed in relation to minimising the spread of Yellow Crazy Ants are supported.	Support noted.
9-23 Dhimurru Aboriginal Corporation	Dhimurru has expressed concern regarding the impact of construction on access to specific Designated Recreation Areas. Dhimurru understand that the ROW will or may intercept access corridors for the Giddies Creek and Rockholes camping areas and the Wonga Creek camping areas. Where the ROW does intercept access corridors arrangements will need to be implemented to minimise inconvenience to our management program and access permit holders. These matters should be considered well in advance of any closures.	Pacific Aluminium acknowledges the areas of impact are close to designated recreational areas within the IPA. The KGGP project team will inform Dhimurru well in advance the timing for potential access restrictions or closures required of IPA recreational camping locations. Pacific Aluminium will also assist Dhimurru to provide public notification to advise permit holders if interruption is to occur at recreational sites due to project activity.

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9-24 Dhimurru Aboriginal Corporation	Dhimurru would appreciate inclusion in the development of archaeological heritage management involving sites located within the Dhimurru IPA.	Agreed. Pacific Aluminium is committed to undertake further archaeology work in the IPA and will involve Dhimurru to inspect, review and develop the archaeological heritage management.
9-25 Dhimurru Aboriginal Corporation	Dhimurru supports the objective of maximising employment opportunities for local Indigenous people in connection with the project however note that this should not be at the expense of current, long term, sustained positions in local businesses. In other areas there have been examples where skilled labour has been drawn from existing businesses having a damaging impact on those businesses.	Pacific Aluminium acknowledges the need to clearly communicate to local potential employees the short term opportunities associated with the KGGP project. Pacific Aluminium understands this may impact areas closer to towns such as Nhulunbuy and Katherine and may be different in remote communities where opportunities are not as great. Where possible, Pacific Aluminium would like to draw on existing local businesses and organisations such as regional councils to perform subcontracting work to ensure continuity of sustainable employment for locals.
9-26 Dhimurru Aboriginal Corporation	Pacific Aluminium's commitments to working with Indigenous landholders and Indigenous Rangers particularly are noted and we look forward to exploring the best way to maximise collaborative outcomes.	Pacific Aluminium acknowledges the importance of working collaboratively with Dhimurru and other external stakeholders to build trustful relationships where mutually beneficial outcomes are achieved. Pacific Aluminium understands the need to engage directly with landowners and ranger groups. The ongoing dialogue and two-way interaction ensures the project team is well informed of appropriate local context and takes this into consideration throughout the duration of the project.
9-27 Dhimurru Aboriginal Corporation	Dhimurru will give further consideration to the EMP noting that it is of a provisional nature and subject to further development pending results of surveys and WRO refinement. Dhimurru will forward any comments it has on the EMP directly to Pacific Aluminium.	Pacific Aluminium welcomes the opportunity to work closely with Dhimurru and acknowledges the benefits of sharing results to develop the EMP.
10-1 NT	Based on available data and understanding of the current distribution and habitat	See section 5.4 of the EIS Supplement regarding *Ectrosia blakei*.

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Department of Land Resource Management	requirements of relevant species, the EIS appears to correctly identify matters of national environmental significance potentially affected by the development; provides a generally accurate assessment of the habitat values; and also accurately assesses the residual risk posed to these values after the proposed mitigation measures. It should be noted however, that the EIS does not recognise the possible presence in the Mitchell Range section of the pipeline route of the annual grass *Ectrosia blakei*, listed as Vulnerable under the EPBC Act. The original collection locality of the species - "5 miles east of Goyder river crossing" - is almost certainly close to the Central Arnhem Road, although the geocode accuracy on the collection is low and does not agree with the locality description. The species usually grows in sandy soil in Eucalyptus forest, woodland or Melaleuca woodland, which is likely to be encountered on the pipeline route. It is recommended that the Supplement considers the potential presence of this species and appropriate mitigation measures, which may include targeted survey near the known locality during a suitable season, noting that there are issues in separating this species from the similar *Ectrosia laxa* and *E. schultzii var annua*.	
10-2 NT Department of Land Resource Management	The EIS refers to monitoring of Gouldian Finch populations in the vicinity of the pipeline, both in a 3-year period following construction and (presumably over a longer time frame) associated with the habitat management offset. Experience has shown that the design of a monitoring program with the power to determine statistically significant trends in such a mobile and seasonally variable species is quite complex, and appropriate ecological and statistical expertise will need to be sought in the development of such a program.	Noted. The primary purpose of monitoring will be to better understand the population and resource use in respect of intended habitat improvement through better fire management. Appropriate advice would be sought on the design of the program.

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10-3 NT Department of Land Resource Management	Appropriate mitigation measures are proposed in the EIS to reduce the risk to fauna from being trapped in open sections of the trench during construction. It is noted that the 'capture' of vertebrate fauna in such trenches can provide valuable data about the distribution of poorly known species or the biodiversity of poorly known areas. The implementation of systems for reliable identification and reporting of animals removed from the trench is therefore strongly encouraged.	See section 6.2.10 and Appendix D of the EIS Supplement providing additional detail on the procedures for fauna handling.
10-4 NT Department of Land Resource Management	Hygiene and weed seed spread prevention • This area requires more detail, and is essential in both construction and operation phases of the project. Previous wash-down facilities when the field survey was conducted were only located at Mainoru (Appendix C Table 11) • The Risk Assessment (Chapter 5) generally underestimates the likelihood of increases in weed infestations and it is almost certain that there will be an increase in weed infestation due to the 'Physical Presence of Infrastructure and Vehicle Movements', as observed in other infrastructure construction and maintenance in the Northern Territory • More stringent control of the hygiene of machinery and materials entering and moving along the project site is required as well as more comprehensive and strategic locations of clean down facilities in relation to weed populations	Pacific Aluminium acknowledges concerns regarding the assessed level of weed risk. As foreshadowed in the Provisional Weed Management Plan, a more detailed assessment of risk would be undertaken to inform appropriate preventative and management actions using criteria outlined in section 6.2.7 of the EIS Supplement. Pacific Aluminium acknowledges that the most effective form of weed management is prevention. A range of preventative measures (outlined in section 6.2.7 of this EIS supplement) would be implemented according to levels of assessed risk in identified weed management areas.
10-5 NT Department of Land Resource Management	Target weeds species, extent • Information on specific weed occurrence, distribution and abundance should be further improved (Appendix C 4.4.2). Field surveys conducted in 2003/04 and a desktop review of the Department's Weeds website (Appendix C	Pacific Aluminium acknowledges their obligation to comply with weed management plans developed under the NT *Weeds Management Act* for Prickly Acacia, Gamba Grass, Bellyache Bush, Mimosa and Chinee Apple. As indicated in the Provisional Weed Management Plan (Appendix O, Draft EIS), baseline

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	4.4.1) shows that weed infestations (incidence and location), especially that of Gamba grass, have changed considerably since the field survey was conducted in the project area. • The proponent listed species as classified as Weeds of National Significance (WONS), but there was no recognition in the EIS of the five grasses listed as Key Threatening Processes under the EPBC Act, or of the weeds covered by Weed Management Plans under the Act. Grader grass also needs to be included as a target weed as it is one of the main concerns of pastoralists in the Katherine region. • The proponent needs to ensure population data and mapping on weed species is updated and collated and needs to be aware of their obligations under the Act to ensure their management plans are consistent with the specific statutory Management Plans for a number of species relevant to the Project Area (e. g. Prickly Acacia, Bellyache Bush, Gamba grass).	data on the extent of weed species within and immediately surrounding the project area will be collected and documented prior to construction. Pacific Aluminium recognises that a national threat abatement plan (DSEWPaC 2012) is in place to address the key threatening process declared under the EPBC Act of 'ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced Gamba Grass (*Andropogon gayanus*), Para Grass (*Urochloa mutica*), Olive Hymenachne (*Hymenachne amplexicaulis*), Mission Grass (*Pennisetum polystachion*) and Annual Mission Grass (*Pennisetum pedicellatum*)'. A reconnaissance inspection undertaken along the Central Arnhem Road and existing access tracks from Katherine to the Goyder River in July 2013 found significant infestations of Grader Grass. Some of these extended for several kilometres along, and up to several hundred metres in, from tracks and roadsides. This weed is recognised as being of significant concern with respect to outcompeting native pastures, decreasing pastoral productivity and increasing fire risk, and will therefore be included as a target species in the Environment Management Plan.
10-6 NT Department of Land Resource Management	Weed management Post-Construction Phase • The EIS should not be limited to the construction phase of the project. Subsequent maintenance of the Right Of Way and surrounding areas can also increase weed infestation and distribution as may be seen on roadsides currently through weed spread by a range of dispersal means (e. g. slashers, grader contractors, pig hunters) • The EIS does not specify the life of the project (Appendix O: Table 16-3) or	As specified in Chapter 2 (Table 2-2) and Appendix O (Provisional Decommissioning Plan) of the Draft EIS, the KGGP would be designed with an operational life of 50 years. As foreshadowed in the Draft EIS a weed risk assessment will be undertaken. This will identify key weed management areas and outline for each of those areas: • Specific weed management goals in the short, medium and longer term

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	how many years the project will document the extent of existing and any new infestations during construction and operation phases (Appendix O: Table 16-3). The EIS should elaborate on the management and contingency plans for at least the 5 years after completion of the construction phase.	which align with existing statutory management strategies and plans. • Levels of monitoring and control in key weed management areas, including the range of most appropriate control methods to be used and the length of time over which monitoring and control measures are required.
10-7 NT Department of Land Resource Management	Provisional Weed Management Plan • The Department acknowledges that this is a provisional plan and presumes a more detailed and operational plan will be developed if the project is approved. If this is the case, the Department recommends that the proponent contacts them for advice, particularly pertaining to the areas identified above as requiring additional consideration	More detailed planning for weed management (consistent with the Provisional Weed Management Plan) will be incorporated into the Construction EMP. Additional weed information in the project area is being collected during the 2013 field season (see section 6.2.7 of this EIS Supplement) and Pacific Aluminium intends to discuss arrangements and seek advice from the Department of Land Resource Management, as suggested by the comment.
10-8 NT Department of Land Resource Management	Chapter 1: Applicable NT legislation - Weeds Management Act 2007 not listed (although is discussed elsewhere in the document).	The omission of the *Weeds Management Act* from Chapter 1 was inadvertent however the obligations and requirements of this legislation are addressed throughout the draft EIS and the EMP (Appendix O).
10-9 NT Department of Land Resource Management	Appendix C: 6.3.2 "Class D weeds". The Northern Territory does not yet have a Class D declaration status	This comment refers to a typographical error on page 35 of Appendix C (Vegetation & Flora Study), Section 6.3.2: Management. The reference should have been to “Class B Weeds,” i.e. those declared weeds for which growth and spread are to be controlled, under the NT *Weeds Management Act* and in accordance with the NT Weed Management Handbook (2012)

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10-10 NT Department of Land Resource Management	Matters of National Environmental Significance (Chapter 10) and *EPBC Act*; the 5 grasses are not mentioned in this context	The reference is to five species of grasses added to the List of Key Threatening Processes under the EPBC Act. They do not comprise Matters of NES (the subject of Chapter 10 of the draft EIS). Of the five grass species, Gamba and Mission Grass were discussed in the weeds section of Chapter 8: Vegetation, and these two plus Para Grass in Appendix K: EPBC Act Protected Matters Report. Appendix C (Vegetation& Flora Study) includes all five, with comments on their significance and management. Final Weed Management Plans will explicitly include these five weeds and document commitments in relation to preventing their spread. See section 6.2.7 of this EIS Supplement for additional information on how the risk based approach will address the five grasses recognised as key threatening processes.
11-1 NT EPA	The draft Environmental Impact Statement (draft EIS) notes that there are information gaps and additional surveys that are intended to be submitted as part of the Supplement to the draft EIS (Supplement). These include, but are not limited to: • Flora surveys; • Fauna surveys; • Archaeology surveys (including the area between KP400 and 440 in the Mitchell Ranges, and approximately 15km between Annie Creek and Goyder River); • Karst identification; • Geotechnical assessment of proposed Horizontal Directional Drilling (HDD)	The Draft EIS noted that a number of studies were intended to be conducted during 2013 and completed before construction. Consistent with the general approach of including information where appropriate to predict environmental impacts, additional information resulting from additional flora and fauna surveys conducted, is presented in Chapter 4 of this EIS Supplement. Further analysis deriving from these surveys together with consideration of implications for assessment conclusions provided in the Draft EIS, is provided in Chapter 5 of this EIS Supplement. Other technical studies relevant to the design phase of the project have been scoped and subject to landholder consent have been scheduled for the latter part of 2013. The results of these studies are integral to design and will be available for consideration by regulators when the Construction EMP, Pipeline Management Plan and approvals are considered.

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	sites; • Social Impact Assessment consultation; • Identification of potential nesting and dry season habitat for Gouldian Finch (including the proposed survey between KP0 and KP140); • Water availability and extraction potential; • Access track site location; and • Other outstanding surveys to be conducted in areas where access has previously been difficult, including but not limited to sections of the Mitchell Ranges. The results from the aforementioned surveys, consultation and assessments should be clearly identified as being new information in the Supplement. A discussion of how the results differ from previous knowledge and how the results and findings obtained from the additional research fill information gaps should be included. This information should be incorporated, where relevant, in the identification and quantification of potential impacts, risk assessment and environmental management plans.	
11-2 NT EPA	The draft EIS notes that components of the construction design and logistics of the proposed Katherine to Gove Gas Pipeline (KGGP) are conceptual and that the finer detail decision-making would be undertaken either during the design phase (e.g. Appendix U) and/or on the ground by the construction contractor (e.g. HDD assessment) during construction. While the Northern Territory Environment Protection Authority (NT EPA) acknowledges that some specific information cannot be obtained during the Environmental Impact Assessment (EIA) process for the KGGP proposal, it is difficult to fully understand the risks	See above regarding information gaps. See section 6.2.1 of this EIS Supplement for additional information concerning arrangements for implementing management commitments made in this EIS.

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	and appropriateness of mitigation measures without this information. Concerted efforts should be made to: • Address the information gaps in the Supplement; • Clearly explain the roles and responsibilities of those involved in executing the KGGP proposal; and Clearly explain how the construction contractor will take ownership of the Environmental Management Plan (EMP), and related documentation, and any commitments made by the Proponent during the EIA.	
11-4 NT EPA	On 5 November 2012, the then Northern Territory Environment Protection Agency received the Notice of Intent for the KGGP proposal for consideration under the Environmental Assessment Act (EA Act).	The date of submission of the NOI referred to in the Executive Summary is incorrect and as indicated in the NT EPA comment, should have read: 5 November 2012.
11-5 NT EPA	It is stated in Section 13.3.2 of the draft EIS that '*at least 30 m of the line would be destroyed'.* Appropriate wording should be considered here and throughout the EIS to reflect the impact of the construction of the KGGP proposal on the remains of the North Australian Railway line.	Section 13.3.1 of the Draft EIS indicates that the area of the North Australian Railway line that would be disturbed consists only of the gravel base on which the line was laid. This site is not protected under Federal or Northern Territory heritage legislation, has been assessed as having low historic significance and there a more extant remains of the railway elsewhere along its former route.
11-6 NT EPA	The NT EPA has not received notification of the withdrawal of the Trans Territory Pipeline (TTP) project. Clarification is sought regarding the Proponent's intent to withdraw the TTP project.	On 22 July 2013, Pacific Aluminium advised the CEO of the Department of Lands, Planning and Environment of the withdrawal of the TTP project from consideration under the *Environmental Assessment Act*.
11-7 NT EPA	The scope of the EIA for the KGGP proposal should also include the	See section 3.1 and 3.9 of this EIS Supplement.

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	decommissioning and/or removal of the permanent and temporary components of the project. This is not clearly communicated in Section 1.5 of the draft EIS and should be better defined in the Supplement.	
11-8 NT EPA	Provide indicators or criteria that would be used to determine the '*actual cessation of the 2013/14 wet season*'. Please describe what is meant by '*buffer period'* and how the period will be enforced/managed to ensure the conditions are appropriate to commence construction. Outline contingencies in the event of an irregular dry season or prolonged/larger than average wet season.	The Bureau of Meteorology's consulting services will be used to predict the cessation of the 2013/14 wet season. The Bureau of Meteorology information has been examined and the Bureau consulted for the planning of the project. The Bureau will be engaged to provide project specific forecasting services as the project progresses. The Bureau indicates that El Nino / La Nina predictions generally start to manifest twelve months ahead; at this time, the situation is neutral and no extremes have emerged at this time for the 2013 / 2014 wet season. Therefore, current planning is based on statistical median conditions. The Bureau advises that conditions tend to be more predictable three months ahead of weather events with precision of prediction improving as the forecast time gets shorter. The statistics indicate that the cessation of the wet season is distinct. The Bureau will be relied upon to indicate when that wet season has ceased. The ground will need to dry out before construction commences. The time between the end of the wet season and commencement of construction is referred to as a buffer period. Extensive canvassing has commenced of the local landowners and local communities to understand how long the ground takes to dry out after the cessation of the 2013 / 2014 wet season, that is, how long will be that buffer period. There is not only the question of the land drying out, but also the state of the waterways to be crossed by vehicles and equipment. To ensure the conditions are appropriate to commence construction, the buffer period will be

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		enforced/managed by regular inspection of the site. The conditions need to be dry for high production of the pipeline spread. If there are sections which are slow to dry out, these will be skipped and the pipeline will be constructed after these slow to dry out sections are suitable. The contingencies in the event of an irregular dry season or prolonged/larger than average wet season are to delay the works accordingly. The statistics indicate that once the wet season has finished, there is a distinct window in which construction can be reliably carried out. The timing of the dry season, hence the construction period, varies over the pipeline routes geographical location. The general rainfall pattern is that rain starts and finishes slightly earlier in the west of the pipeline route compared to the east of the pipeline route. Historical data shows generally about one month difference in the heavy rainfalls.
11-9 NT EPA	In Sections 2.5.1 and 2.6.8 of the draft EIS it is inferred that the majority of the works would be undertaken between 6 am and 6 pm. Clearly identify the times and instances when work would occur outside of these hours in the Supplement. Clearly indicate the lighting requirements and potential noise impacts associated with works to be conducted outside of the normal operational hours in a relevant section of the Supplement.	The typical working day for the construction crew will be 06:00 am to 6:00 pm which includes travel from the accommodation camp to the work site and return. Construction will occur 7 days/week. There will be activities outside these typical times: • NDT (Non-destructive testing / x-ray) activities will be required when construction personnel are not present. These activities involve x-ray of the pipe and will be performed after 6:00pm for undefined durations. Low levels of noise will occur when undertaking these X-Ray operations. Lighting will be by localised flood lights directed toward the immediate worksite to offer a safe working environment. Minimal light spill (if any) is

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		expected beyond the ROW. • Equipment repairs and equipment movement/float may require works after 6:00pm. Such works would be on an “as and when required” basis and be production driven. • Typically trenching equipment may work extended hours to achieve the daily production quota. Repairs to this type of equipment are frequent. Noise generated by such trenching operation or repair operations will be no greater than those of the daylight operations. When in proximity to sensitive receptors / local communities, trenching activities will be restricted to daylight hours where possible to minimise impact. Equipment lighting and localised flood lighting will be used to offer a safe working environment. Minimal light spill (if any) is expected beyond the ROW. • Pipeline Hydrotesting operations are a 24hour operation for no more than a 36 hour period. This 24 hour test period is to verify the integrity of the pipeline section is a noiseless operation requiring only localised lighting for those persons monitoring the testing operation. • HDD operations will require 24 hour working, particularly during the drilling operations.
11-10 NT EPA	The buoyancy control measures have the potential to create points of concentrated scour in the river channel, potentially leading to accelerated erosion during times of high flow and/or changes to the hydrodynamics of the river system. Further information is required regarding the targeted buoyancy controls to be used at specific waterway crossings or waterway crossing types.	See 6.2.3 of this EIS Supplement. The Construction EMP will include measures relevant to coating/protective measures and watercourse crossings, noting that the risks to the aquatic environment from these aspects are considered low.

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	When addressing the buoyancy control measures in the Supplement, a description of how the integrity of the measures will be monitored and maintained and the potential impact on the hydrodynamics as a result of these measures should be discussed. Provide information on how damage to the pipeline buoyancy control measures or the pipeline at waterway crossings would be identified and repaired during various stages of the proposal. Reference to pipeline coating is not made in Section 4 of Appendix O. The EMP should be updated to include the provisions and management of coating of the pipeline and other protective measures of the pipeline, specific to the waterway crossings.	
11-11 NT EPA	Section 6.3.2 of the Guidelines for the Preparation of an Environmental Impact Statement stipulates that the following information was to be provided in the EIS: *'The extent of, and risks associated with, trenching and biodiversity (Section 4.5), including reference to:* • *the types of fauna, particularly which species are most vulnerable to falling in the trench; and* • *the duration and distance for sections of trench to remain open.'* There are some apparent inconsistencies in the information provided regarding the exposed trench. Information varies between the main body of the draft EIS	See 6.2.10 of this EIS Supplement.

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	and Appendices B and N. For example, it is stated that under good trenching conditions, the trench would be open for approximately 3 weeks at a distance of approximately 40km. In Appendix B, it is stated that larger crossings would require the trench to be open for up to 4 days. Please clarify these apparent inconsistencies by distinguishing between dry land trenching and waterway crossings. In the Supplement more information is required to: • Define what is meant by 'open trench', i.e. excavation to full coverage; • Clearly identify the proposed timing and locations of the open trench; • Define how the construction schedule would coordinate the trenching schedule with the HDD and horizontal drilling; and • Describe the duration and distance of the proposed open trench at water crossings.	
11-12 NT EPA	The information provided in Section 9.1.3 of the Draft EIS indicates that the proposed KGGP route would avoid areas of high faunal conservation value, '…*however, it is inevitable that animals would still be captured and therefore appropriate measures need to be in place to facilitate their escape or assisted removal'*. Using the information provided in Section 9.1.3 of the draft EIS, indicate what types of fauna, with particular reference to listed species, are most vulnerable to falling in the open trench. The inclusion of relevant data relating to trenching and biodiversity into the threat analysis table presented in Appendix 1 of Appendix N would be useful to	See section 6.2.10 of the EIS Supplement which provides additional detail around the species most vulnerable to trench fall. Additional detail on the procedures to be applied to monitor and remove fauna from the open trench is provided at Appendix D to the EIS Supplement. Appendix N to the Draft EIS (referred to in this comment) documents risks to the pipeline from external factors and specifically those that might result in pipeline failure. Chapter 5 of the Draft EIS deals more broadly with risks from construction and operation. The risks to fauna from trench fall are acknowledged in this risk assessment (see Table 5-16).

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	make meaningful comparisons between environmental setting, key threats and predominant land-use at sections along the proposed KGGP route.	
11-13 NT EPA	In Section 2.6.7 of the draft EIS it is noted that the pipeline would be tested in 11 sections along the proposed KGGP route, averaging 55km. Clarify when the hydrotesting would be conducted in relation to the schedule presented in Section 2.4 of the draft EIS. Indicate the expected timeframes over which the 11 test sections would be open.	See section 6.2.4 of this EIS Supplement.
11-14 NT EPA	The NT EPA supports the use of selective drilling techniques to minimise the environmental impact on waterways along the proposed KGGP route. However, further information is required regarding the process for selecting waterways for HDD and the potential impacts on the waterways, including riparian zones and in-stream flora and fauna, from the proposed action. Information to be provided in the Supplement should include: • A definition of 'minor flows'; • Criteria for the assessment of waterway flows; • If a 'cease to flow' criterion is determined to be required, an indication of how 'cease to flow' would be determined and who would be responsible for determining 'cease to flow'; • Detailed description of the schedule, mobilisation and logistics of the construction contractors for HDD and horizontal boring (i.e. would the identification of sites requiring HDD be completed during top-soil stripping and stockpiling, prior to trenching? How will the rigs be moved from site to	See section 6.2.3 of the EIS Supplement providing a Risk Assessment and Adaptive Management methodology for watercourse crossings and additional detail on HDD.

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	site and across waterways, if required?) ; • A justification for the proposed HDD for only 9 of the 26 major waterway crossings identified in the draft EIS; • In the event that '*unforseen geotechnical considerations preclude HDD*' , alternative construction methods including any diversions, flume pipes, barriers, partial weirs, temporary dams, pumps and blasting and how these will be designed or managed to ensure minimal impacts to waterways; and • Consideration of both dewatering and management of flow techniques.	
11-15 NT EPA	*Boggy Creek – potential for impacts on hydrology of waterhole which has a small outflow* Clarify the meaning of this statement. Indicate the distance between the sinkhole identified by Golder (2004) in the area east of Boggy Creek and the proposed Boggy Creek crossing. Given the proximity of Boggy Creek to karst terrain, provide information on any further considerations or potential impacts associated with the use of HDD or mobilisation of machinery at the proposed Boggy Creek crossing.	The statement in question relates to the rationale for selecting HDD for this watercourse crossing in respect of avoiding disturbance to surface flow. See also section 6.2.3 of the EIS Supplement regarding the low potential for HDD to result in cracking of aquifers The sinkhole identified by Golder (2004) is approximately 6.5 km eastward of the proposed Boggy Creek crossing. At its closest point to the pipeline, the sinkhole is approximately 440 m south of the centerline of the pipeline corridor. If the alternative alignment discussed in section 3.3.6 of this EIS Supplement was pursued, the sinkhole would be approximately 6.5km from the Boggy Creek crossing and at its closest point to the pipeline, would be 350m south of the centerline of the pipeline corridor. Published geological mapping of this area <u>does not</u> indicate a widespread occurrence of soluble carbonate rocks and karst formations. From the available information, it is considered that only isolated karst features may be present in this area. See section 6.2.2 of this EIS Supplement re further consideration of karst terrain, future investigations and management arrangements. A site specific risk assessment and mitigation (if

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		required) will be undertaken using the findings of the detailed mapping, geophysical and geotechnical investigation studies to be conducted during the design phase.
11-16 NT EPA	Section 3.2.3 of the Guidelines for the Preparation of an Environmental Impact Statement stipulates that the following information was to be provided in the EIS: *'Permanent and temporary access tracks and roads, and the duration of accessibility'* Further information is required regarding the types of vehicles and types of materials that would be transported on the access tracks (e.g. HDD rigs, pipeline segments or worker access) is required. In the event that access tracks are used to transport larger materials or machinery, indicate the likely area required for turn-around areas.	See section 3.6 and 6.2.6 of this EIS Supplement.
11-17 NT EPA	Further information is required in the Supplement regarding the proposed decommissioning and rehabilitation of the ancillary infrastructure and access tracks associated with the KGGP proposal.	See sections 3.6, 3.7 and 6.2.6 of the EIS Supplement providing additional detail on access track and construction camp decommissioning and rehabilitation. This will be undertaken consistent with the Provisional Rehabilitation Plan (Draft EIS, Appendix O).
11-18 NT EPA	The information provided in the draft EIS indicates that up to 134km of the proposed KGGP route would occur in potential karst landscape. Further information is required to define the areas: • where karst features, such as sinkholes, springs and streams that	See section 6.2.2 of this EIS Supplement.

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	connect to subsurface caves, currently exist; and • that are potentially susceptible to karst feature formation or land subsidence as a result of the proposed action. Information provided for the assessment of karst features and potential formations should include: • a description of the recognised scientific or cultural importance of the karst features, where relevant; • a summary of the complexity of identified karst features, including a summary of the relationship between localised geology, water, soil, vegetation and atmospheric elements; • further measures for the protection of karst features or potential karst formation, such as buffer zones, avoidance of sink holes and methods to ensure stable vegetation cover in areas susceptible to karst feature formation.	
11-19 NT EPA	The information provided in the draft EIS indicates that approximately 12 km of the proposed KGGP would be constructed in soils classified as vertosol and hydrosol. Explain the implications, if any, that the excavation and installation of the KGGP in these areas would have on the design, installation and construction of the pipeline. Discuss any impacts the proposed works and vehicle movement in these areas might have on stability during construction. With specific reference to vertosols, describe how the soil properties (e.g. shrink-swell) would necessitate different levels of management and protection to ensure	See section 6.2.2 of the EIS Supplement.

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	the integrity of the pipeline and surrounding materials are maintained. With specific reference to hydrosols, describe how the soil properties (e.g. prolonged submersion) would necessitate different levels of management and protection to ensure the integrity of the pipeline and surrounding materials are maintained.	
11-20 NT EPA	In Section 6.3.3 and Appendix B of the draft EIS it is implied that approximately 30km of the proposed right of way (ROW) would occur in areas where Acid Sulfate Soils (ASS) are potentially present. Further information regarding the investigation into the presence of ASS in the ROW, including field-based studies, is required in the Supplement. Indicate how ASS would be identified by the construction contractor if it were to occur outside the areas identified during the preliminary desktop study, and describe the subsequent procedure for management of the ASS. Discuss the risks associated with the potential exposure of ASS around wetlands and waterways. Given that the areas identified as Ef land system are located within ~ 20km of Nhulunbuy, discuss the potential to undertake the field testworks early in the project schedule identified in Section 2.4 of the draft EIS. Early identification of ASS would ensure that the mitigation measures identified in Appendix O are undertaken as soon as practicable.	See section 6.2.2 of the EIS Supplement.

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11-21 NT EPA	Further information is required regarding how representative and reliable the data provided in Table 6-2 (App B) are for providing a baseline for the proposed waterway crossings. Please define 'max flow' and how this relates to bankfull estimates. It is recommended that the Proponent use consistent units of measurement to describe discharge in the relevant tables and throughout the main body of the document. The data provided in Table 6-2 is useful for understanding the streamflow and characteristics for five of the nine waterways identified as requiring HDD. A similar baseline, or equivalent if available, for the other four waterways should be provided in the Supplement.	The data presented in Table 7-1 of the draft EIS (and Table 6-2 (App B)) has been extracted from the former Department of Natural Resources, Environment, the Arts and Sport (NRETAS) stream flow database. The database was updated following the restructure of the NRETAS and is now maintained by the Department of Land Resource Management (DLRM). The network of stream gauging stations operated by DLRM is relatively sparse. All available data has been extracted from those gauges located on watercourses to be crossed by the proposed pipeline. The 'Max. Flow' data is the maximum recorded flow extracted from the monthly summary flow data. It is noted that the updated streamflow database provides maximum recorded flows for some gauges that are not available from the monthly summary data due to the database quality control procedures for incomplete data sets. Table 7-1 of the draft EIS (and Table 6-2 of App. B) have been be updated to include the revised maximum flows – see section 6.2.5 of the EIS Supplement. The gauge sites are generally located some distance away from the proposed crossing sites. Flood studies are being undertaken at the present time to estimate design flood peak flows for watercourse crossing sites, (HDD and open trench crossings), having catchment areas greater than 20km^2 for buoyancy control design and scour estimation. . The maximum flows correspond to flood events and are therefore significantly greater than bankfull flows. There is insufficient data available to enable bankfull flows to be estimated at the present time. The bankfull flows can be estimated following the ground survey of the waterway crossing sites and flood studies.

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		The adopted flow units are m^3/s for instantaneous flows, with L/s adopted for low flows as pump capacities are typically quoted in L/s, and ML adopted for discharge volumes. The stream flow of all waterways proposed for water extraction will be measured in the weeks prior to the proposed extraction to determine the existing conditions and suitability for extraction at that time. Stream flow will be measured by area-velocity method.
11-22 NT EPA	Construction of new bores should be undertaken by a NT registered driller and appropriate research should be undertaken to ensure that the bores slot are positioned appropriately to intersect the targeted aquifer(s) and avoid cross-contamination of aquifers. The most appropriate location for bores should be determined by undertaking research into water quality and availability. Local landowners should be involved in the consultation and decision-making process. Further information regarding the assessment of groundwater as a source of water for the KGGP should be presented in the Supplement.	See section 6.2.5 of this EIS Supplement.
11-23 NT EPA	In respect of section 7.2.1, further information is required to: • describe how suitable and representative downstream and upstream locations would be determined; • define '*excessive*' in this context and how this relates to NT water rule that '*at least 80 % of flow at any time in any part of a river is allocated as water for environmental and other public benefit water provisions and extraction for consumption uses will not exceed the threshold level equivalent to 20*	See section 6.2.5 of this EIS Supplement.

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	% of flow at any time in any part of a river'; and • describe the method for gauging or monitoring streamflow and extraction to protect the waterways. With specific reference to the 9 waterway crossings identified as requiring HDD, indicate whether these locations are also proposed surface water extraction points.	
11-24 NT EPA	Further information is required regarding the data presented in Section 7.2.1 and Tables 7-1 and 7-3, including: • an explanation for the increased water demand in October and November of 2014 compared to the previous months; • the source, and reliability of the source/data provided, in column titled 'estimated flow' for each 'stream' identified in Table 7-3; and • An explanation for how the information in Table 7-1, which presents a summary of streamflow data for 5 gauging stations, was used specifically to generate the data presented in Table 7-3. Provide an indication of the proximity of the locations presented in Table 7-3 to the areas identified as requiring HDD.	Monthly demands for construction water requirements have been estimated based on scheduled construction activities and predicted availability of water sources (surface water and groundwater) over the course of the construction period. It is anticipated that additional water demand will be required toward the end of the dry season (October / November) for dust suppression and camp water use and for hydrotesting of the pipeline which will occur at the end of construction. As the majority of streams are ungauged, the estimated monthly flows in the streams at the potential extraction locations listed in Table 7-3 were calculated using the averaged monthly runoff depths shown on Figure 7-2 for the nearest gauged stream listed in Table 7-1 and catchment areas at extraction locations. See also section 6.2.5 of this EIS Supplement.
11-25 NT EPA	In respect of section 7.2.1, explain what is meant by '*average*' conditions. Indicate the location of the proposed surface water extraction points.	'Average' conditions refer to flows that have been estimated using monthly averaged runoff for the periods of records at the nearest streamflow gauge and catchment areas above the potential extraction locations.

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		See section 6.2.5 of the EIS Supplement regarding locations of proposed surface water extraction points.
11-26 NT EPA	Confirm that a depth of 2000mm will be used for wetland crossings and whether the proposed wetland crossings are at the locations identified in Section 9.1.1 and Appendix C. Further information regarding the proposed techniques for constructing and crossing management of wetlands should be included in the Supplement.	The pipeline design principles and construction techniques applied to wetland crossing are similar to those for watercourse crossings and areas of flood inundation. As for watercourse crossings, the depth of cover shall be determined based on the requirement for buoyancy control and for scour protection at each crossing and shall be between 1200 mm and 2000 mm. The pipeline design (buoyancy control and scour protection), construction method and easement reinstatement / rehabilitation techniques at each of the wetland crossings will be determined during the detailed design and optimised during construction on completion of the ground intrusive investigations and flood modelling studies. Construction techniques typically utilised in areas of wet and unstable ground conditions, such as wetlands include: • Construction schedule to prioritise crossing during predicted period of driest ground conditions. • Use of lighter and manoeuvrable backhoe machinery in favour of trenching machines. • Use of bog mats to stabilise ground. • Potential requirement for pumping water from trench. • Use of trench boxes to maintain integrity of trench walls during construction. • Use of shorter pipe sections to minimise trench opening period.

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		• Building of access road with geotextile and compacted gravel. The wetland crossings identified were based on sites identified during the 2003/04 vegetation and flora surveys. Examination of aerial imagery has not confirmed their location and this will be undertaken during further investigative survey during the design phase. It is expected that any wetlands will be ephemeral and not be holding water at the location of crossing but, see information above regarding unstable ground conditions.
11-27 NT EPA	Further information is required regarding how the intended extraction/use of water, either by surface or groundwater extraction, would be communicated to impacted parties (e.g. landowners).	See section 6.2.5. Pacific Aluminium has well established engagement mechanisms described in section 6.2.11 and in this Table that will be used to communicate proposed water extraction to landholders and affected parties.
11-28 NT EPA	The criteria that will be used to determine '*a suitable site for land disposal'* is outlined in 7.2.3. Indicate the decision-making process and person responsible for selecting the site for suitable hydrotest water disposal. The statement that the hydrotest water would be disposed of within the pipeline ROW contradicts previous reference to the vegetation clearing of the ROW, where *'stable (rocky) vegetated areas'* suitable for the disposal of hydrotest water would be unlikely to exist. Clarification is sought if this is the pipeline corridor.	See section 6.2.4 of this EIS Supplement.
11-29 NT EPA	In reference to Table 7-6 of the draft EIS, please define '*minimum ' dry' season flow*'.	Table 7-6 in the EIS has been reproduced from the Water Resources Assessment Report (Table 6-3) included as Appendix B to the draft EIS. The

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		Assessment Report (page 16) states: *"The 'dry' season flows listed in Table 6-3 are average flow rates based on the minimum monthly runoff depths plotted on Figure 6-3 and the catchment areas above the crossing site."*
11-30 NT EPA	It is noted that the entire pipeline route cannot be comprehensively surveyed at this point. However, this has resulted in conservative assessments of very large amounts of potential habitat for various listed threatened and migratory species to be cleared. The draft EIS states for a number of species that clearing of important habitat for particular species (e.g. Tall woodland within 2km of permanent water for the Red Goshawk and Northern Masked Owl or *Eucalyptus tintinnans* stands for the Gouldian Finch) will be minimised via the final alignment of the ROW within the pipeline corridor. As the pipeline will be constructed at a rate of 5 to 6km per day, further clarification is required as to how the pipeline corridor will be surveyed in advance of the pipeline, how habitat or features important to EPBC-listed species will be identified and how this route selection would take place in practice. An assessment of the certainty of identifying particular habitat features and an assessment of the ability to avoid such features should be provided.	See sections 5.1 of the EIS Supplement which provides more detailed vegetation mapping analysis and sections 5.5 to 5.9 that detail additional habitat analysis (based on more detailed vegetation mapping) that refines impact analysis of potential habitat for a number of species and provide additional detail on avoidance and minimisation of habitat disturbance through alignment of the ROW within the pipeline corridor and reduced working width of the ROW.
11-31 NT EPA	Further explanation is required as to how groundwater extraction will occur so as not to alter the hydrological regime of water resources or EPBC-listed species' habitat, including refuge pools for freshwater sawfish, waterholes for Gouldian finch and other EPBC-listed fauna and any important habitat that	Water needs for the project are of short duration, temporary and are not large. Within those parameters, the water supply strategy for the project indicates that groundwater extraction would be considered secondarily to surface water extraction. Groundwater extraction, if required will occur within limits established

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	consists of groundwater dependent vegetation. The explanation should consider the effectiveness and level of certainty in the ability to select groundwater bore sites to achieve this aim. It is noted that the intention is to adhere to the NT guideline to restrict the amount of water extracted to 20% of recharge. An assessment of the relevance of this threshold in achieving the above stated aims to prevent changes to water resources or EPBC-listed species' habitat, including refuge pools for freshwater sawfish, waterholes for Gouldian finch and other EPBC-listed fauna and any important habitat that consists of groundwater dependent vegetation should be provided.	through licensing under the *Water Act*. In this context, impacts from groundwater extraction on hydrological regimes important for the maintenance of EPBC listed species, are unlikely. The EMP for the project (Appendix O, Draft EIS) includes a commitment that any extraction of groundwater will not be located in areas where extraction could foreseeably lead to a significant alteration in the hydrological regime of known Gouldian Finch watering locations and/or regionally significant wetlands. Similarly extraction of groundwater will not be located in areas where extraction could foreseeably lead to a significant alteration in the hydrological regime of known habitats for the freshwater sawfish, particularly where extraction would be in proximity to refuge pools (no surface water extraction will occur from refuge pools). Both of these commitments will be achieved through refinement of the Water Supply and Adaptive Management Strategy (see Chapter 7, Draft EIS) and will incorporate additional hydrological assessment at the site of proposed groundwater extraction (if required), informed by an ecologist and (in the case of Freshwater Sawfish, an independent expert on this species).
11-32 NT EPA	Provide a detailed methodology for surveys and site selection for the other infrastructure, such as camps and compressor stations so as to minimise any impact to listed threatened or migratory species and their habitat, or provide more precise location information for this infrastructure.	The Site Selection Protocol (Draft EIS, Appendix U) provides a methodology for site selection of infrastructure such as construction camps and access tracks. The Protocol will be refined during the design phase and information collected during surveys will be incorporated into the project GIS to inform decision making under protocol. Such information for example will include the location of identified breeding (and coincident dry season foraging) habitat for the Gouldian Finch, the records of threatened flora species and identified weed infestations.

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		The protocol will be supported by detailed vegetation mapping over all areas of potential disturbance and on-ground assessment by a qualified ecologist during the site selection process/ design phase. A commitment to preparing and submitting a report within 6 months of completion of construction demonstrating how the access tracks/camps were designed and constructed to avoid and mitigate impacts on the species of concern and their habitat, is made in section 3.6 of the EIS Supplement.
11-33 NT EPA	Further detail is required regarding the ways in which trench clearing will take place over 80 to 120kms of open trench in such a way as to occur prior to dehydration and predation of trapped EPBC-listed fauna. Further discussion of mitigation measures, including the possible use of trench skirting, use and effectiveness of shelter and ramps and a discussion of the proposed management for feral animals found trapped in the trench should be provided. In addition, a description of any mitigation measures to protect fauna for the 50m of open trench that will remain open at hydrotesting points until hydrotesting is complete is required.	An open trench of 80-120 km is not envisaged within one construction spread. Under good trenching conditions approximately 40-60 km of open trench is expected within a construction spread. See section 6.2.10 of the EIS Supplement which provides additional detail around trenching operations (including open trench at hydrotest points) and risks to fauna. Additional detail on procedures for monitoring and reducing risks to fauna entering the open trench is provided in Appendix D to the EIS Supplement.
11-34 NT EPA	Given the volumes of hydrotest water to be discharged, further information regarding the threshold of 100m from waterbodies and justification as to whether this is sufficient to prevent contamination of water resources should be provided.	See section 6.2.4 of the EIS Supplement which provides revised information on disposal of hydrotest water. Addition of chemicals to hydrotest water is not envisaged and the internal epoxy coating lining of the pipe would avoid the potential for mill scale breakdown and residue formation as can be experienced for unlined pipes. Specific site assessment of disposal locations by the project Environment Manager would ensure: • The receiving ground is not prone to erosion.

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		• The water flow does not lead into or adjacent to an existing watercourse. • The water does not soak into drainage areas for watercourses or bores used for domestic water supply. • The water is not discharged onto a site with significant habitat value for flora or fauna. • All containment and erosion control measures are in place.
11-35 NT EPA	Describe the maintenance work that would be required at watercourses and how these will be undertaken so as to minimise impacts to sawfish and other listed threatened or migratory species.	See section 6.2.3 of the EIS Supplement which describes the monitoring regime for watercourse crossings and (if required) repair work. Maintenance in the form of regular scheduled works on watercourse crossings is not envisaged. Areas identified as having scour or subsidence would be repaired as soon as possible. Typically repair of surface scour involves replacement and/or installation of additional scour controls. Trench material would be replaced, compacted and reinstated in areas of subsidence. As per the original crossing, repair works would be undertaken with the objective of restoring the watercourse to as near as possible to its natural profile. Barriers to fish movement are not envisaged. The use and movement of equipment would be undertaken so as to avoid or minimise disturbance to riparian vegetation. Repair works would be scheduled at a time when ground conditions allow for minimal soils disturbance. Where repair works are required for watercourses identified as potential habitat for the Freshwater Sawfish, the option of seeking the opinion of an expert on this species will be retained
11-36 NT EPA	Provide an assessment of the potential impacts to EPBC-listed species as a result of hydrotest water disposal in evaporation ponds. Further detail regarding	See section 6.2.4 of the EIS Supplement. Physical barriers would be employed to deter usage of water storage ponds by wildlife. Biocides are not envisaged to

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	the construction methods of these ponds is required and consideration of the potential impacts to EPBC-listed species using the ponds as a water source should be provided. Mitigation measures to protect EPBC-listed species from any impacts caused by ingestion of water should also be considered.	be used but if required will be screened using a risk assessment methodology to ensure low mammalian and bird toxicity at the anticipated concentrations.
11-37 NT EPA	Quantification of the temporary nature of the impacts of any clearing where active rehabilitation and/or natural regeneration is proposed is required.	The Draft EIS quantified that 60% of the ROW would be likely to return to native woody vegetation through a mixture of active rehabilitation and natural regeneration. This is a conservative estimate based on the width of the ROW required to be maintained free of woody vegetation (areas immediately above the pipeline and for permanent access along the ROW). The clearing for all construction camps would be temporary and these areas rehabilitated. A significant proportion (at this stage estimated to be approximately 50% but subject to further design) of the access tracks away from the ROW would be temporary and be rehabilitated and return to native woody vegetation. Revised estimates of vegetation clearing required for the project and the proportion expected to return to woody vegetation are provided in section 3.8 in the EIS Supplement.
11-38 NT EPA	Address the potential impacts of potential ASS disturbance when trenching the three wetlands on the Australasian Bittern, Australian Painted Snipe and other EPBC-listed species and provide detail regarding management measures to minimise any potential impacts.	The wetland crossings identified were based on sites identified during the 2003/04 vegetation and flora surveys. Examination of aerial imagery has not confirmed their location and this will be undertaken during further investigative survey during the design phase. If confirmed, it is expected that any wetlands will be ephemeral and not be holding water at the time of construction and at the location of crossing. Two of the three wetlands occur at KP394 and KP516, which do not occur within lands

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		that have the potential for ASS as described in Chapter 6 of the Draft EIS. Only the wetland at KP 594 is located in an area identified as having the potential for inland ASS. Impacts on the Australasian Bittern, Australian Painted Snipe or other EPBC listed species attracted to wetland habitats are not anticipated as these wetlands are unlikely to be holding water when construction occurs and the species are therefore unlikely to be present. Impacts associated with ASS to these species are also therefore unlikely but will be managed consistent with the overall strategy to avoid ASS problems through the ASS Management Plan (see section 6.2.2 of this EIS Supplement.
11-39 NT EPA	Please provide further assessment of the potential for HDD to lead to cracking of aquifers or alteration of water catchments, and an assessment of potential consequences to sawfish and other listed species.	See section 6.2.3 of the EIS Supplement. The potential for fracturing the aquifer is managed through careful site specific assessment including geotechnical assessment deriving from boreholes placed either side of the crossing to determine groundwater conditions. By assessing the borehole data, the HDD bore profile can be manipulated to avoid problems. HDD activities would aim to avoid fracturing an aquifer through the management arrangements set out in section 6.2.3 of the EIS Supplement and impacts on water resources important for EPBC listed species are unlikely.
11-40 NT EPA	Provide more information on the Bare-rumped Sheathtail Bat, Yellow Spotted Monitor, Merten's Water Monitor and Mitchell's Water Monitor. In particular, the terrestrial fauna survey failed to adequately survey for the listed bat species.	See sections 5-11, 5-12, and 5-13 of this EIS Supplement.
11-41 NT EPA	Infra Red remote cameras generally target warm blooded fauna and are less	See section 6.2.9 of this EIS Supplement.

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	effective for terrestrial reptiles. Provide further information regarding the techniques and results of terrestrial reptile monitoring.	
11-42 NT EPA	In order to quantify the potential impacts to the Red Goshawk, please quantify how many hectares of possible nesting habitat (tall trees within 1km of a permanent waterbody) may be cleared for the pipeline and associated infrastructure, and clearly describe how impacts to this habitat and any nesting Red Goshawks will be minimised through the final alignment of the pipeline and infrastructure, or other management measures.	See section 5.5 of this EIS Supplement. Additional mitigation to minimise disturbance is also provided in section 3.4 of the Supplement in respect of positioning the ROW and reduced working width for short sections when passing through areas of high habitat value.
11-43 NT EPA	The potential impacts to the Gouldian Finch need to be quantified, particularly in terms of the amount of breeding habitat, dry season foraging habitat and wet season foraging habitat that may be cleared. Given that there is considerable Gouldian Finch potential habitat mapped east of the Beswick/Chambers River region (as per Figure 1 Appendix F- 4) and abundance estimates of 25 – 75 birds near Bulman (Figure 10-3) through which the pipeline route passes, survey effort for the Gouldian Finch outside of the Beswick/Chambers River region is limited. The draft EIS notes temporary clearing of up to 1850ha of possible wet season foraging habitat, with a residual impact of 703ha of possible wet season foraging habitat remaining unrehabilitated. While it is noted that this is a conservative estimate, without this impact being refined further, it is possible that clearing of Gouldian Finch breeding and wet season foraging habitat could constitute an unacceptable impact on the species, given their very specific habitat requirements and dietary specialisation.	See section Chapter 4 of this EIS Supplement regarding additional survey for Gouldian Finch habitat and section 5.6 of the Supplement providing additional habitat and impact analysis, mitigation and offset commitment.

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11-44 NT EPA	In order to quantify the potential impacts to the Gouldian Finch outside of the Beswick/Chambers River area, consideration should be given to undertaking Gouldian Finch resource mapping, targeted surveys or other vegetation surveys outside of the Beswick/Chambers River area so as to quantify the amount of habitat that may be cleared for the pipeline and associated infrastructure. The assessment of impacts should give adequate consideration to wet season foraging habitat, dry season water resources, breeding trees and the interaction between these resources as these are considered to be key limiting resources for the species.	Although the potential habitat mapping for the Gouldian Finch presented in the EIS depicts broad areas of high potential habitat across the pipeline corridor, few records of the species exist to the north-east of the Beswick/Chambers River area (Figure 10-5, Draft EIS). Given the historic records of the species in the Bulman area, this location is considered to be one of the more likely areas along the pipeline corridor outside the Beswick/Chambers River area that could contain potential habitat for the species; however, there still exists the possibility that Gouldian Finch habitat occurs in other areas along the pipeline. For this reason, the management approach to be taken when constructing the pipeline in areas of known Gouldian Finch breeding habitat will be applied across the construction of the entire KGGP project wherever any Salmon Gums with potentially suitable nesting hollows are located. The specifics of these management measures are described further in section 5.6 of the EIS Supplement.
11-45 NT EPA	The Supplement should include the methods and results of the 2013 dry season survey undertaken to investigate the relationships between wet season feeding habitat along the pipeline corridor and other tall stands of *E. tintinnans* outside of the corridor. This information should be considered in the assessment and quantification of impacts.	The results of the 2013 dry season survey have been included in the Supplement (see section 4.5).
11-46 NT EPA	The way in which impacts to Gouldian Finch habitat, particularly wet season foraging habitat, dry season water resources and breeding trees, will be minimised through the final alignment of the pipeline and infrastructure or other management measures should be clearly described, particularly for areas	The key management measures for avoidance and minimisation of impacts to Gouldian Finch breeding and dry season feeding habitat are: • Avoiding or minimising disturbance of trees with nesting hollows by re-alignment of the ROW within the pipeline corridor.

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	through which targeted Gouldian Finch surveys or habitat surveys have not taken place.	• Narrowing the ROW where possible to further reduce the number of trees with nesting hollows required to be cleared. • Timing the removal of Salmon Gums to avoid disturbance of active nests. • Creating artificial nesting habitat in nearby areas using hollows from Salmon Gums that cannot be avoided through the above measures. A Risk Assessment and Adaptive Management Strategy for watercourse crossings incorporating the use of HDD and the option of delaying other crossings until they are dry, will minimise impacts on dry season water resources for the Gouldian Finch. Removal of wet season foraging habitat will be minimised through management planning directed at reducing vegetation clearance to as low as possible and rehabilitation of the ROW initially to a stable grassy landform which will rapidly reinstate this habitat. See section 5.6 of the EIS Supplement for further details of above.
11-47 NT EPA	In addition, provide the methods, results and outcomes of the surveys undertaken to clarify whether the Gouldian Finch breeding habitat patch can be avoided or impact minimised, confirm that the two more distant patches will be avoided (10-44) and confirm whether the water resources associated with the Gouldian Finch sightings can be avoided as referenced in the draft EIS on 10-44 and 10-45. Detail regarding the avoidance and proposed mitigation measures should be provided. Where avoidance is not possible through realignment of the pipeline, consideration and discussion of the use of HDD to avoid this habitat should be provided.	Clarification and quantification of potential impacts to Gouldian Finch breeding habitat (which is also analogous to dry season foraging habitat as stated in the Draft EIS) and wet season foraging habitat is detailed in the Supplement and is summarised in the above responses. With regard to water resources, the key Gouldian Finch water resource identified (the waterhole located near KP118) will be avoided. The alignment of the ROW will be shifted to the north of the pipeline corridor, allowing for a distance of approximately 190 m between pipeline centerline and the waterhole (see section 5.6 of the EIS Supplement).

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		Avoidance and proposed mitigation measures are described in section 5.6 of the EIS Supplement.
11-48 NT EPA	Provide an assessment of the extent to which Gouldian Finch breeding, wet season foraging and dry season foraging habitat is groundwater dependant and, if relevant, discuss how impacts to this habitat from groundwater bore extraction will be managed, and the degree of certainty of the effectiveness of any management measure proposed.	The key species forming habitat for the Gouldian Finch include *Eucalyptus tintinnans* (breeding habitat) and spear grasses or native sorghum (*Sarga* species) (foraging habitat) and are not known, or are not documented to be, groundwater dependent. Breeding habitat is not associated with riparian or other groundwater dependent habitats and feeding habitat (grasses) would be shallow rooted.
11-49 NT EPA	Provide an assessment of any proposed offsets for the Gouldian Finch with reference to the EPBC Act Environmental Offsets Policy, October 2012, particularly the principles regarding what constitutes a suitable offset. The offset should compensate for the residual impacts of the action, such as those described in the draft EIS for the Beswick/Chambers River region, but also possible impacts, given the limited survey effort and risk that the pipeline route may clear important habitat such as breeding habitat, or suitable wet season foraging habitat that is in proximity to breeding habitat along the remainder of the pipeline route.	See section 5.6 of this EIS Supplement.
11-50 NT EPA	Given that sawfish rely on electroreception for foraging and movement, provide an assessment of the potential for electrical currents along the pipeline to radiate into rivers when in flow and impact upon the behaviour of sawfish.	Cathodic protection systems utilize very low levels of electrical voltages and currents to maintain pipeline protection. The specific values of the required currents and voltages will be determined based on soil resistivity in the areas of installation. In normal operation the cathodic protection system does not produce an electrical field external to the pipeline except immediately around the anode bed locations, which are nominally 100km apart. In the event of damage

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		to the external pipeline coating due to construction handling during installation or third party interference, the exposed area of bare steel is likely to be small (pin hole or small scrape) but there could be a current generated between the area of damaged pipe coating and the surrounding ground. The intensity of the current would be extremely small and would be impeded by surrounding ground cover which would be nominally 1 m or more to the top of the pipe. In the event of this occurrence, the net current generated at the river bed would be relative to the area of coating damage and resistivity of surrounding soil, but would likely be negligible. Pacific Aluminium has selected world industry best pipeline coating materials as well as a very experienced and professional construction contractor for the installation of the pipeline to minimise potential risk of pipe damage and construction defects. During the pipeline construction and again while pipeline is being lifted and lowered into the trench, the integrity of the coating is fully inspected for any flaws or damage. This allows the construction contractor to make any repairs prior to the pipeline being placed in its final position. The backfill material that is placed around the pipe is carefully selected and screened to prevent damage to the pipeline coating. On completion of the pipeline installation, a coating defect survey is undertaken with any defects repaired. This coating defect survey is repeated on a regular basis over the life of the pipeline to ensure the ongoing integrity of the pipeline coating. In addition an intelligent pig will be run periodically to detect any corrosion that may occur due to coating damage and therefore allow operational personnel to identify and carry out repairs. Once the pipeline is operational,

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		regular aerial and ground patrols are undertaken to detect third party activity and minimise the potential for third party damage to occur along the pipeline. The design life of the external dual layer fusion bonded epoxy (FBE) coating is the same as the design life of the pipeline (50 years). The potential for coating damage within the vicinity of a watercourse is extremely low given the controls taken during construction and operation of the pipeline. Impacts to Freshwater Sawfish are therefore not anticipated.
11-51 NT EPA	Assess the likelihood and potential impacts of blasting or HDD activities fracturing an aquifer, and how this might impact on EPBC-listed species' water resources, including sawfish.	See section 6.2.3of the EIS Supplement. The potential for fracturing the aquifer is managed through careful site specific assessment including geotechnical assessment deriving from boreholes placed either side of the crossing to determine groundwater conditions. By assessing the borehole data, the HDD bore profile can be manipulated to avoid problems. HDD activities would aim to avoid fracturing an aquifer through the management arrangements set out in section 6.2.3 of the EIS Supplement and impacts on water resources important for EPBC listed species are unlikely. Blasting will not be undertaken near any watercourse that is in flow.
11-52 NT EPA	Further detail regarding the impact of HDD under refuge waterholes, including noise, light and waste pollution on the Freshwater Sawfish, if present.	Light is considered unlikely to impact on the Freshwater Sawfish. The species has been recorded in both turbid and clear waters (Thorburn *et al*. 2003), suggesting that it is not a species that avoids areas where light penetrates. Further, larger Freshwater Sawfish have been recorded using deep waters on nights with greater moonlight, possibly as prey is more visible (Whitty *et al*. 2008). Increases in artificial light would be unlikely to affect the distribution of the majority of prey of Freshwater Sawfish given that these (crustaceans, filamentous algae, nematodes and molluscs) are present in soft substratum and

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		would be largely unaffected by changes in light levels. Increases in artificial light associated with HDD activities would be temporary and of short duration. Drilling muds generated from the use of HDD will not be disposed of near watercourses or where they could subsequently be mobilised into watercourse. There have been no studies concerning how man-made sounds might affect sharks and rays in general, either behaviourally or physiologically (Normandeau Associates Inc 2012). However, these species have well-developed ears and there is substantial evidence that they are able to detect and respond to sound, and that sound plays a major role in their lives (Casper *et al.* 2012). Since they have no internal gas chambers, the likelihood of physiological effects from other than the most intense sounds is low, but there are likely to be behavioural effects associated with masking (where detection of one sound is interfered with by another sound), and, perhaps at high chronic sound levels, temporary threshold shift (TTS; where there is a transient reduction in hearing sensitivity caused by exposure to intense sound). The extent to which masking or TTS could occur is not known. The noise levels that will be generated from HDD will be influenced by soil/rock properties. To excavate hard, cohesive and consolidated soils/rock, the driller must apply greater force to dislodge or entrain the material. Underwater sounds due to the use of rock breaking by mechanical action will be considerably stronger than those that do not require the use of breaking. Regardless of possible masking or TTS, it is considered that effects from noise

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		will not significantly impact on the Freshwater Sawfish. Noise will be temporary and of a short duration at each watercourse, occurring only during the HDD activities. During this time, there may be temporary displacement, and the species will be able to return, if disturbed, once construction is complete. Further, the species does not rely on hearing to detect its prey. Rather, like other shark and ray species, it uses the thousands of electroreceptors on its rostrum to detect the weak electrical signal coming from live prey. It then attacks the prey using swift swiping motions before consuming it whole.
11-53 NT EPA	Provide further information on the rehabilitation of river crossings, including evidence of how the rehabilitation methods will prevent erosion of the trenchline when the river is in flood and avoid creating barriers to sawfish movement. The rehabilitation methods where trenching and/or blasting is used should be provided.	Blasting will not be undertaken near any watercourse that is in flow.The location of rock has yet to be fully identified but, according to the project geological records, these areas are away from watercourses.Should rock be required to be removed from watercourses this will be done by mechanical means, pneumatic rock breakers. See section 6.2.3 of the EIS Supplement which provides additional detail on rehabilitation and monitoring of watercourse crossings subject to open trenching. Rehabilitation aims to both reinstate and maintain watercourses as near as possible to original profile. Barriers to sawfish movement are considered unlikely.
11-54 NT EPA	Provide clarification regarding the definition of 'minor flow' and provide detail regarding the actions to be undertaken in these areas and in areas where 'unforseen geotechnical considerations preclude HDD' , including any diversions, flume pipes, barriers, partial weirs, temporary dams, pumps and	Based on current scheduling and watercourse flow predictions, requirement for flow diversion at open cut trenching crossings is not anticipated and a risk assessment and adaptive management process has been developed including the option of delaying construction of crossings in flow , as advised by an

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	blasting and how these will be designed or managed to ensure minimal impacts to sawfish. Consideration should be given both to dewatering and management of flow techniques in the further information.	independent Freshwater Sawfish expert. See section 6.2.3 of this EIS Supplement.
11-55 NT EPA	Further details needs to be provided regarding the water extraction from water sources, including Boggy Creek, which are possible habitat for the freshwater sawfish and how this will be managed so as to minimise potential impacts. Consideration should be given to monitoring downstream water depths and ceasing extraction should these areas reach a level below which sawfish are considered to be unable to move up and down stream.	See section 6.2.5 of this EIS Supplement.
11-56 NT EPA	In respect of section10.15, please describe the 7.35ha of the 'significant riparian vegetation' to be cleared. In particular, describe whether this vegetation contains Melaleuca, Casuarina and/or Pandanus species which are considered nesting and foraging habitat for the species. Please describe what surveys have been or will be undertaken for the species prior to pipeline installation and how impacts to individuals or the species' habitat will be minimised through ROW alignment, use of HDD at more watercrossings or any other measures.	Table 10-33 of the Draft EIS contains a description of the vegetation associated with each watercourse in terms of *Melaleuca*, *Casuarina* and/or *Pandanus* species presence. Of the 16 watercourses where the Gulf Snapping Turtle potentially occurs, there are 7.35 ha of associated significant riparian vegetation. Of these 16 watercourse crossings, there are seven where foraging or nesting habitat is not present, and nine where foraging or nesting habitat is present. Of the 7.35 ha of significant riparian vegetation associated with these watercourse crossings, approximately 4.64 ha contains potential foraging or nesting habitat. Approximately 1.9 ha of this potential foraging or nesting habitat would be avoided through the use of HDD construction. No Gulf Snapping Turtles were recorded during the aquatic fauna survey (Appendix E, Draft EIS). The closest historical record of Gulf Snapping Turtle is

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		approximately 38 km south of the pipeline ROW, in the Roper River. See section 6.2.3 of the EIS Supplement for a description of the Risk Assessment and Adaptive Management approach to selection of watercourse crossings, including the options of additional HDD and deferral of open cut crossings for watercourse crossings that are flowing. Identified watercourses providing potential habitat for the Gulf Snapping Turtle will be incorporated into this risk based approach. See section 3.4 of the EIS Supplement regarding additional proposed measures to reduce habitat impacts through placement of the ROW within the corridor and reduced working width.
11-57 NT EPA	Without detailed survey effort and without further information regarding the location of associated infrastructure and methodology for and effectiveness of realignment of the pipeline, it is considered that there is a real risk that the activity could clear important habitat or features for a number of listed threatened and migratory species, including: • breeding trees for the Red Goshawk; • habitat utilised by an isolated subpopulation of the Northern Crested Shrike Tit; • breeding hollows for the Northern Masked Owl; • denning/shelter habitat for the Northern Quoll; and • nesting sites for the Gulf Snapping Turtle In addition, given the steep decline in small mammals in the region, any deaths of Northern Brush-tailed Phascogales, Northern Quolls, Golden-backed Tree-	See Chapter 5 of the EIS Supplement providing additional impact analysis for the species referred to in this comment using (in most cases) improved vegetation mapping and habitat analysis. Section 3.4 of the EIS Supplement provides additional detail on the mechanisms at pipeline survey that will be used to avoid and minimise disturbance to important habitat including placement of the ROW within the pipeline corridor and reduced working width of the ROW. This is supported through the use of Alignment Sheets to guide the constructor in ‘on-ground’ decision making. For those species potentially subject to falling into the trench, additional detail has been provided in respect of the risks associated with mortality and the procedures for monitoring and clearing the trench to reduce these risks (see section 6.2.10 of the EIS Supplement and associated Appendix D). Additional detail on the selection of watercourse crossings has been provided in respect of a Risk Assessment and Adaptive Management approach which

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
	rats or Brush-tailed Rabbit-rat from trench capture are of concern. Without further survey effort or further certainty regarding the effectiveness of mitigation measures, it is possible that impacts to the above species could be considered significant and that offsets would therefore be required. Further certainty regarding the importance of the area for the species and mitigation measure effectiveness should be provided, or offsets in accordance with the EPBC Act Environmental Offsets Policy, October 2012 should be proposed.	includes provision for additional HDD crossings or deferral of open cut crossings for watercourses in flow, subject to on ground risk assessment. It is considered that the additional analysis and information regarding mitigation referred to above combined with the information presented in the Draft EIS, provides sufficient justification that significant residual impacts (within the meaning of the EPBC Offsets Policy) for those species are unlikely to result from implementation of the KGGP Project.
11-58 NT EPA	The schedule presented in Section 2 of the draft EIS indicates that construction works would commence in early 2014. Given the expected construction commencement date is fast approaching; the project construction timeframe is short (i.e. one dry season); and specialised skills are required for pipeline construction and installation, discuss the feasibility of sourcing local workers or training local people for employment on the KGGP project.	The 2014 construction period offers the advantage of skilled pipeline personnel becoming available from the major Queensland pipelines, with planned completion late 2013 or early 2014. As per response to comment 7-65, a Local Employment Plan will be developed with full engagement of local communities and organisations. Local workers will be engaged and trained according to their skills. Local workers will be sought through local subcontractors for a variety of work such as manufacture of timber skids, clearing and grading, installation of pipeline signs, various camp services, fencing, hire of water cart and other suitable equipment. It is proposed to offer community employment by utilising the services of Ranger Groups and specialised Indigenous organisations with construction capabilities who can monitor the integrity of the watercourse reinstatements and weed management activities. Pacific Aluminium is scheduled to conduct interviews with government, non-government organisations and training providers in Darwin, Katherine and

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
		Nhulunbuy between the months of October to December 2013. Based on the information gathered and interviews with communities along the pipeline route, the KGGP project will develop a skills database to link Aboriginal traditional owners and locals to jobs and training associated with the KGGP project. The purpose is to identify the level of interest, skills and training of Aboriginal traditional owners and locals. The information gathered will form the basis of training to be offered. The KGGP will utilise the current successful training programs at the Gove Operations based in Nhulunbuy. The KGGP may also use NT and Commonwealth government and non-government organisational training as necessary. KGGP is also committed to have sufficient mentors identified to support local employees who are training and working with the KGGP project.
11-59 NT EPA	There are a number of information gaps or unknowns highlighted in Appendix B that relate to the information requirements as stipulated in the Guidelines for the Preparation of an Environmental Impact Statement for the KGGP. This information is pivotal to allow interested stakeholders to understand the risks to water resources as a result of the KGGP proposal. The relevant text extracted from Appendix B (column to the left) should be address in the Supplement.	Where uncertainties exist, risk management and adaptive management approaches have been developed to allow for additional information collected during the design phase to be used in decision making, with the aim of reaching an acceptable environmental outcome. Specifically, a Risk Assessment and Adaptive Management approach has been documented in the EIS for watercourse crossings and similarly, a Water Supply and Adaptive Management Strategy will provide a framework for managing water extraction for the project. These risk management frameworks will be refined during the course of the design phase, in consultation with the relevant government authorities. Other matters identified in Appendix B are addressed in response to other comments

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
		in this table and in Chapter 6 of the EIS Supplement.
11-60 NT EPA	Geomembrane liners generally have a low permeability and are not used to *'prevent seepage'*. HDPE materials or similar are more reliable and impervious than geomembranes.	The comment refers to the following statement in Appendix B of the draft EIS: "A number of temporary small turkey nest dams may be constructed adjacent to watercourses for storage of water extracted from watercourses for construction water supply purposes. The dams and ponds will also require geomembrane liners to prevent seepage and potential local impacts to groundwater quality, levels and flow dynamics." 'Geomembrane liner' is somewhat a broad term comprising various geosynthetic and synthetic materials including High Density Polyethylene (HDPE), Polyvinylchloride (PVC) and Geosynthetic Clay Liners (GCL). A comparison study of the various geomembrane liner products will be undertaken when selecting the product for this application. Typically the product would satisfy the following criteria: • Low permeability. • High ultra violet (UV) resistance. • Resistant to wide range of chemicals. It is likely that HDPE liners will be considered for this purpose as the product is frequently used throughout the industry, generally satisfy the above criteria and are less prone to puncture than other synthetic geomembrane liners.
11-61 NT EPA	Relates to Appendix B of the draft EIS: An analysis of any changes to the hydrologic regime as a result of pipeline construction should be provided in the Supplement in response to following statement in Appendix B	Changes to the hydrologic regime as a result of pipeline construction (i.e. water crossing) are expected to be negligible as all watercourse crossings will be reinstated to natural conditions, thereby preventing any changes in hydrologic

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
	Impact on hydrologic regime is from a water extraction perspective only and does not account for the changes as a result of the construction.	regime or hydraulic behavior. As such, water extraction from surface waters is the only construction activity considered to have potential for impact on the hydrologic regime.
11-62 NT EPA	Describe the risks associated with blasting of waterway crossings and in-stream biota and bank stability.	No blasting will be permitted close to or at watercourse locations when they are in flow. The location of rock has yet to be fully identified but, according to the project geological records, these areas are away from watercourses. Should rock be required to be removed from watercourses this will be done by mechanical means, pneumatic rock breakers.
11-63 NT EPA	One hair tube (out of 100) secured a hair sample. Explain the reliability of this sampling methodology and how it relates to the EPBC guidelines for surveying mammals.	See section 6.2.9 of this EIS Supplement.
11-64 NT EPA	Social assessment is to be based on consultation with and involvement of the community. This is to be achieved through interviews and meetings with potentially affected groups including residents, landholders, particular industry participants and interest groups, service providers and government agencies. Consultation should cover project construction, operational and decommissioning phases, and consequences of land use change. Further information is required regarding the Social Impact Assessment for the KGGP and should include but not be limited to:	See section 6.2.11 of this EIS Supplement.

SUBMISSION REF. AND SUMBITTER	COMMENT	RESPONSE
	• a summary of consultation undertaken; • a summary of methods used during consultation and techniques used to communicate the EIS to interested stakeholders; • the extent of difficulties associated with languages and literacy; • a list of meetings and engagements; and • preliminary outcomes as a result of the consultation. Provide an indication of whether all interested parties or stakeholders have been consulted and agreed to the proposed KGGP route and terms.	
11-65 NT EPA	App. O Abbrev : EA Act – Environmental Approvals Act. This should be Environmental Assessment Act.	Agreed and this has been corrected. The error was inadvertent and the legislation is correctly identified throughout the remainder of the draft EIS.
11-66 NT EPA	A number of key environmental and cultural constraints identified in the main body of the draft EIS are missing from Table 1, Appendix U. For example, karst features and ASS.	Agreed and these will be added to the Site Selection Protocol which will continue to be refined during the design phase and within input from further survey and detailed vegetation mapping.


PACIFIC ALUMINIUM

Appendix B

Comparative Risk Assessment for Two-year Build Option

PACIFIC ALUMINIUM

SUMMARY OF ANTICIPATED ENVIRONMENTAL IMPACTS FROM A TWO-YEAR vs ONE-YEAR CONSTRUCTION SCENARIO FOR THE KATHERINE TO GOVE GAS PIPELINE

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
LANDFORM AND SOILS (CH 6)		**NO GREATER**	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Contamination of soils from exposure of acid sulphate soils	**Excavation**		
Contamination of soils from hydrocarbons and other chemicals	**Spills and leaks of hydrocarbons and other chemicals**		
WATER RESOURCES (CH 7)			
Surface Water **Degradation of surface water quality from erosion of soils and landforms**	**Excavation and trenching (including across watercourses)**		
Degradation of water quality through inappropriate disposal of liquid or solid wastes	**Waste disposal, including used hydrotest water, other liquid wastes and solid wastes**		
Degradation of water quality through spills and leaks of hydrocarbons and other chemicals	**Spills and leaks of hydrocarbons and other chemicals**		

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
Surface Water and Groundwater **Contamination of water from exposure of acid sulphate soils**	**Degradation of surface and ground water quality from acidification and mobilisation of contaminants from exposure of acid sulphate soils**	**NO GREATER**	
VEGETATION AND FLORA (CH 8)			Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Disturbance/loss of flora species, including from erosion, sedimentation, or spread of weeds **Amount of vegetation to be cleared**	**Vegetation clearing**		
Degradation of vegetation communities or alteration of community composition from introduction and/or spread of weeds	**Vehicle movements**		
Degradation of vegetation communities through introduction and spread of weeds and/or feral animals	**Physical presence of infrastructure**		
Disturbance/loss of terrestrial and aquatic flora species and vegetation communities through fire	**Fire ignition**		Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Disturbance/loss of flora species through inappropriate disposal of liquid or solid wastes	**Waste disposal, including used hydrotest water, other liquid wastes and solid wastes**	**NO GREATER**	
Disturbance/loss of terrestrial flora species and vegetation communities from deposition of dust	**Dust generation**		

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
VEGETATION AND FLORA – LISTED THREATENED SPECIES AND THREATENED ECOLOGICAL COMMUNITIES (FEDERAL &/OR NT-LISTED)(CH 8)			
All potential impacts identified above (under Vegetation and Flora), e.g. on Arnhem Plateau Sandstone Shrubland Complex TEC and *Pternandra coerulescens*	**All activities identified above**		
TERRESTRIAL & AQUATIC FAUNA (CH 9)		**NO GREATER**	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Loss/degradation of fauna habitat (including aquatic habitat)	**Vegetation clearing**		
Degradation of fauna habitats from introduction and/or spread of weeds **Loss of individuals (mortality) from vehicle strike**	**Vehicle movements**		
Injury, mortality of animals falling into the trench	**Open trench**		
Loss of individuals directly from wildfires in addition to indirect impacts from deposition of silt and ash into waterways (resulting in contamination **Loss and/or fragmentation of fauna habitat from wildfires**	**Fire ignition**		
Disturbance/loss of fauna habitat (including	**Dust generation**		

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
roosting and foraging habitat) from deposition of dust			
Disturbance/loss of fauna habitat through inappropriate disposal of liquid or solid wastes	**Waste disposal, including used hydrotest water, other liquid wastes and solid wastes**	**NO GREATER**	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Degradation of fauna habitat and/or loss of individuals from predation by feral animals	**Physical presence of infrastructure**		
Disruption to nesting/roosting/foraging habitats and/or behaviour	**Noise and vibrations**		
FAUNA – LISTED THREATENED SPECIES (FEDERAL &/OR NT-LISTED)(CH 10; MNES)			
All potential impacts identified above (under Fauna), e.g. on Gouldian Finch, Red Goshawk	**All activities identified above**		
PARKS, RESERVES AND AREAS OF HIGH CONSERVATION VALUE (CH 11)			
Disturbance to recreation or cultural sites	**Increased and/or unauthorised entry**		

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
Degradation of water quality of flowing watercourses	**Trench crossings of watercourses**	**NO GREATER**	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Degradation of habitat quality from spread of Yellow Crazy Ants and other feral animals **Degradation of habitat quality from spread of weeds**	**Vehicle movements**		
Degradation of habitat quality from increased frequency or intensity of fires	**Vehicle movements; construction activities, such as welding; careless disposal of cigarettes; etc.**		
AIR QUALITY (CH 12)			
Degradation of air quality from hydrocarbon and other exhausts	**Pipeline venting or vehicular or fugitive emissions (e.g. when refuelling)**		
Degradation of air quality through plumes of dust	**Dust generation from vehicular movements**		

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
ABORIGINAL AND CULTURAL HERITAGE (CH 13)		NO GREATER	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Vegetation Clearing	Damage to culturally-significant sites outside the project area from unauthorised clearing beyond the project area boundary		
Excavation	Damage to undocumented (buried) sites of cultural significance or skeletal remains		
Unauthorised entry of workers and general public onto sacred sites and other culturally-sensitive sites	Construction activities on Aboriginal Lands and improvement of extension of access tracks		
LAND USE, INFRASTRUCTURE AND AMENITY CONSIDERATIONS (CH 14)			
Existing services and infrastructure			
Deterioration of road quality/integrity	Vehicle movements		
Decreased access to services by local populations	Use of hospitals, health and emergency services by construction workforce		

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
Amenity **Annoyance/traffic impacts from increased vehicle movements on public roads**	**Vehicle movements**	**NO GREATER**	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Excessive noise levels at nearby public/sensitive premises	**Noise and vibrations**		
SOCIAL AND ECONOMIC CONSIDERATIONS (CH 15)			
Training/development and employment for locally-sourced workers	**Training, development and employment**	**POSSIBLY LESS**	Because, under a 2-yr construction scenario the peak workforce would involve approximately 650 workers compared to approximately 980 under a 1-year scenario, fewer training and job opportunities would be associated with a 2-year construction scenario.
Potential procurement and contracting opportunities for local businesses	**Economic development**	**NO LESS**	The same materials and services required for the project constructed under a 1-year scenario would be the same under a 2-year scenario, with approximately half the demand to be met in each of the two years (for construction of the western half in the first year and the eastern half in the second year).

ENVIRONMENTAL FACTOR (RECEPTOR) and POTENTIAL IMPACT	ENVIRONMENTAL ASPECT (ACTIVITY)	OVERALL ANTICIPATED IMPACT FOR A 2-YR PROJECT vs 1-YR PROJECT	RATIONALE/EXPLANATION
HEALTH AND SAFETY (CH 16)		NO GREATER	Management and controls that would apply to the entire project area under a 1-year scenario would, under a 2-year scenario, apply first to the western half and then to the eastern half, in the first and second years, respectively; therefore, the potential environmental impacts would be no greater under a 2-year construction scenario than under a 1-year scenario.
Injury/loss of life for workers	**Vegetation clearing** **Excavation**		
Injury/loss of life of public, from falling into the trench	**Excavation (open trench)**		
Injury/loss of life (public) from trespassing, third party interference with the project; unauthorised tapping of gas pipeline; shooting infrastructure; etc.	**Physical presence of infrastructure** **Gas leaks/ explosions or vandalism**		
Increase in occurrence of social ills (e.g. increased drug and alcohol use)	**Influx of non-resident workers in the project area and region**		
Injury/loss of life (workers and public) from traffic accident on public or project roads.	**Vehicle movements**		
Injury/loss of life (workers and public) from wildfire caused by or exacerbated by project activities (e.g. ignition of combustible materials in the project area)	**Fire ignition**		
Traffic accidents caused by excessive dust generation near public roads	**Dust emissions**		


PACIFIC ALUMINIUM

Appendix C

PACIFIC ALUMINIUM

ELA Vegetation Mapping - Overview

Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 1

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

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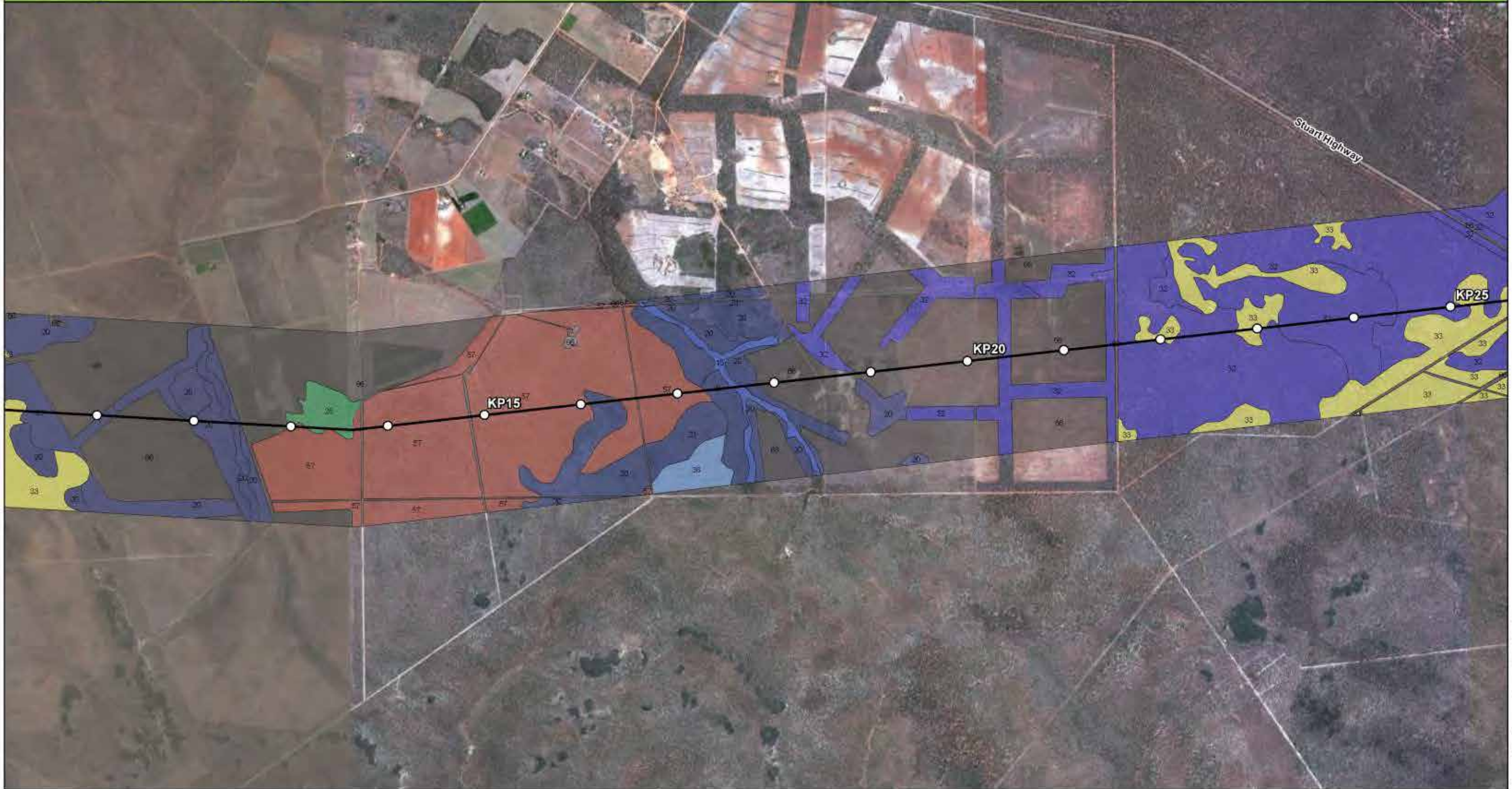
Prepared by: VH Approved by: AZ Status: Draft Date: 27/06/2013

Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 2



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
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- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
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- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
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- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
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- 61 - Sparse shrubland
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- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

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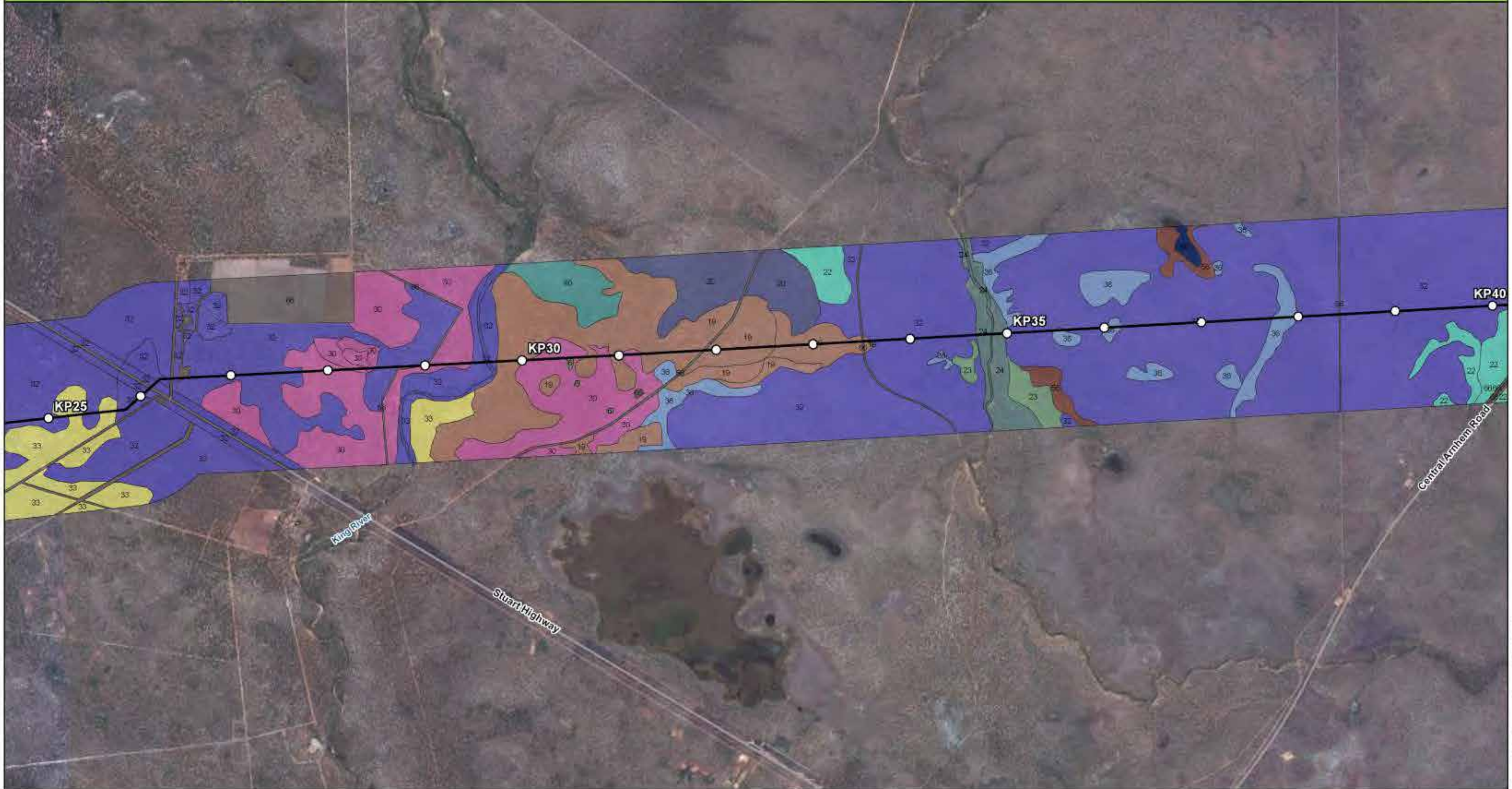
Date: 27/06/2013 Status: Draft Approved by: AZ Prepared by: VH

Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 3



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
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- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
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Kilometres

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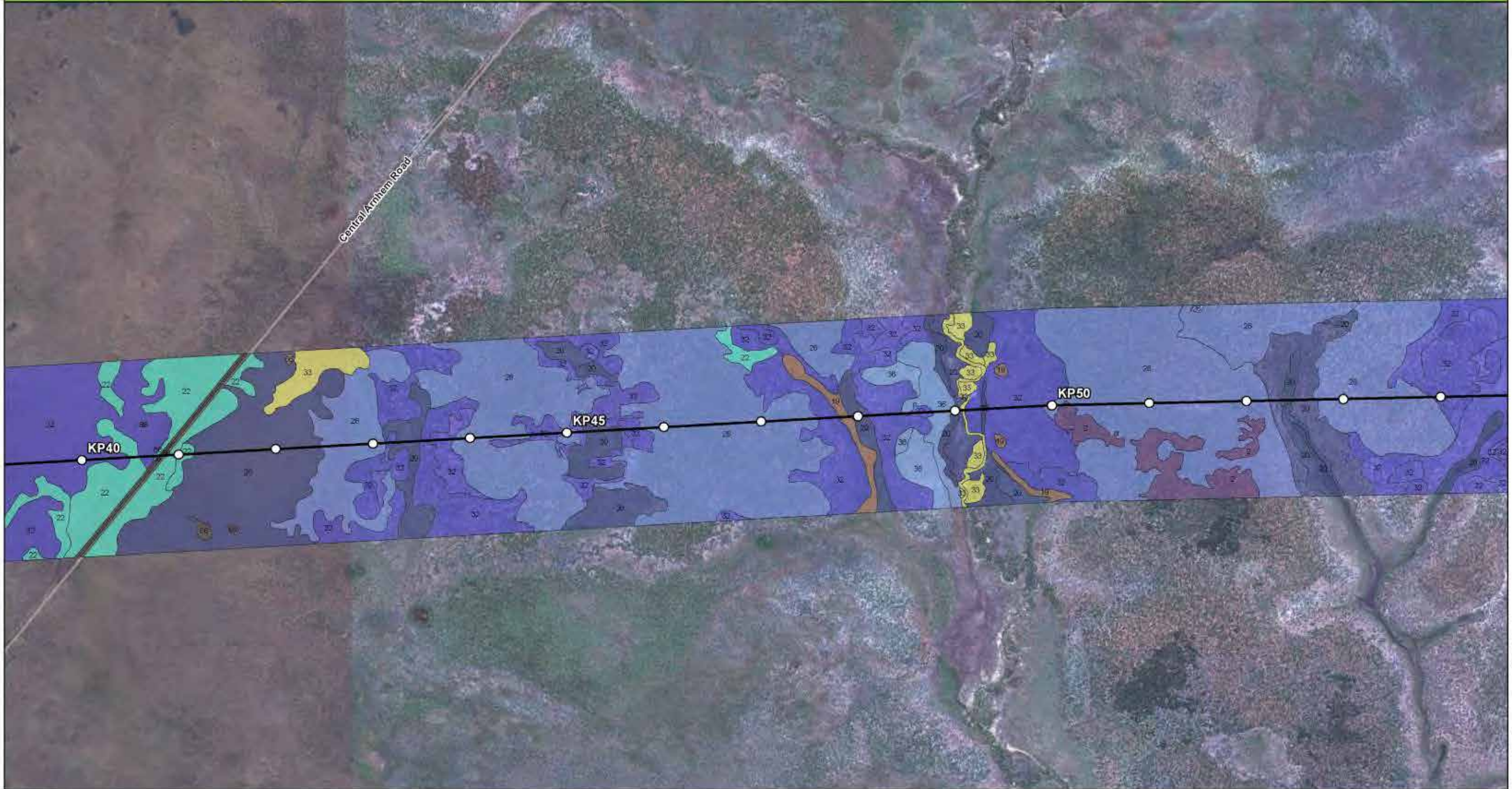
Prepared by: VH Approved by: AZ Status: Draft Date: 27/06/2013

Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 4



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

Datum/Projection:
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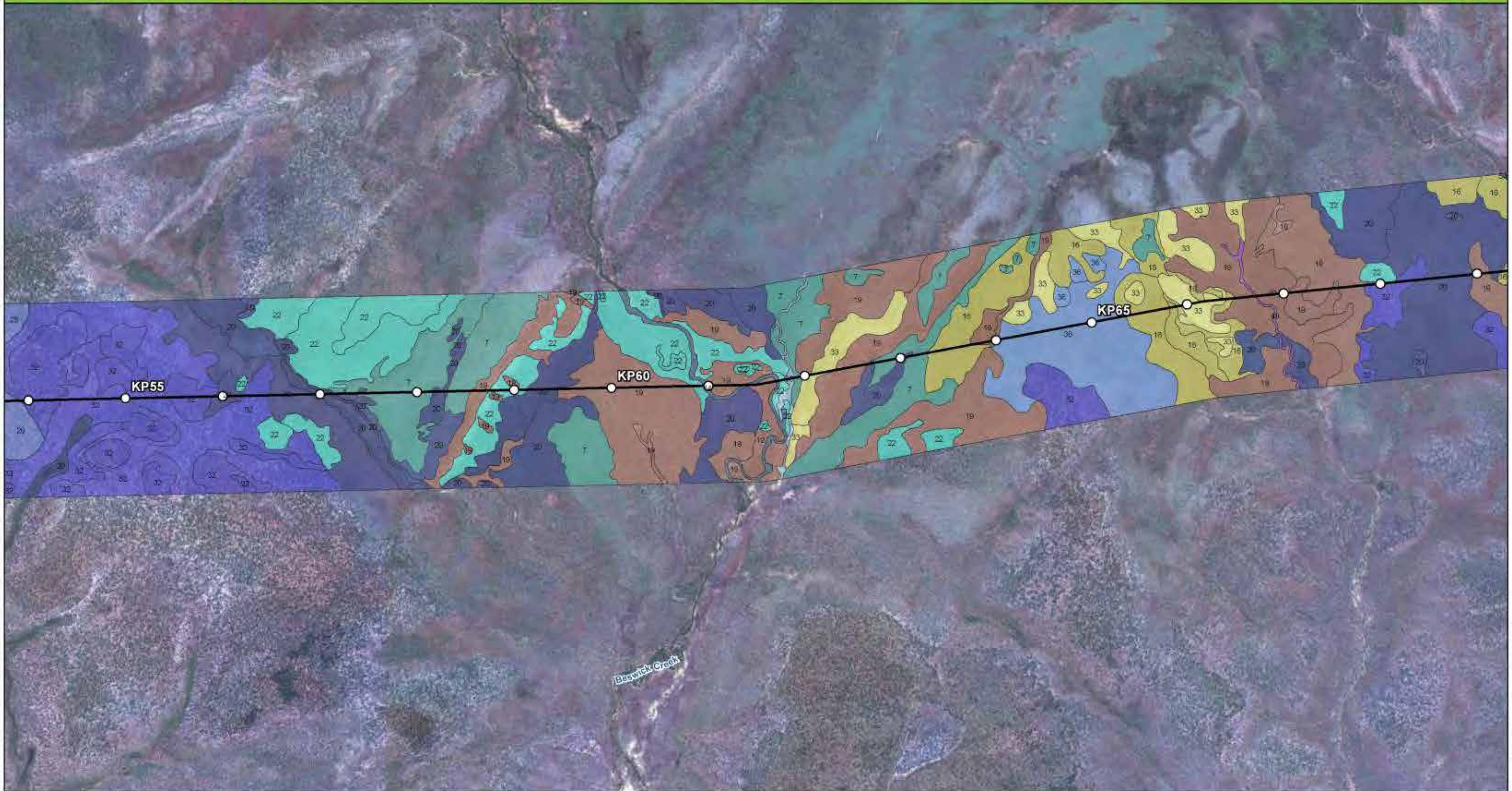
ELA Vegetation Mapping

Tile 5



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
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51 - Melaleuca tall forest
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53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
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58 - Platyzoma swamp
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66 - Pastoral / Horticultural / Roads / Developed

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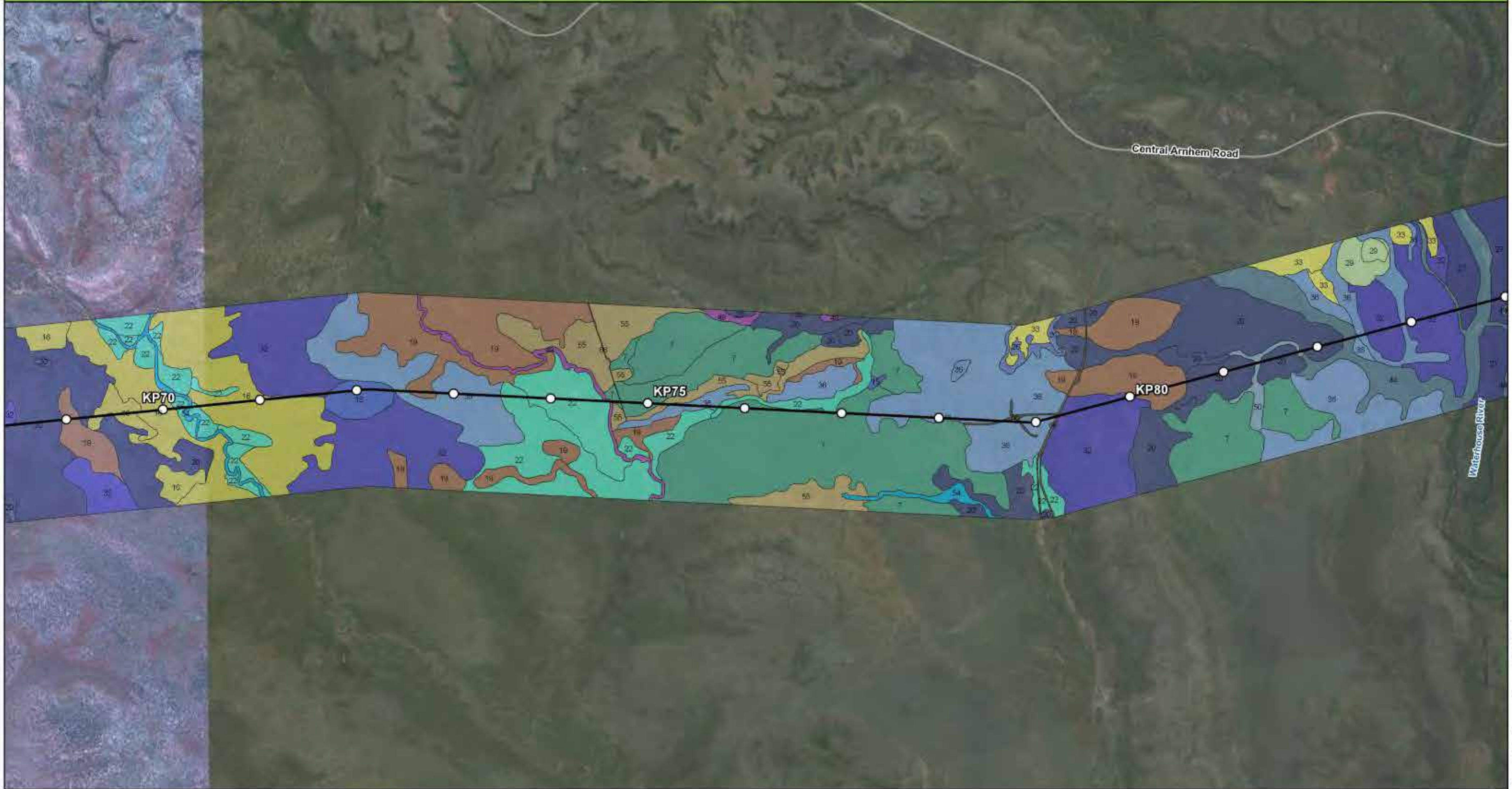
ELA Vegetation Mapping

Tile 6



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
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- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
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- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
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- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
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- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
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- 62 - Tussock grassland
- 63 - Vine forest
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- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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ELA Vegetation Mapping

Tile 7

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
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- 35 - Eucalyptus tall woodland
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- 44 - Melaleuca closed forest
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- 50 - Melaleuca open woodland
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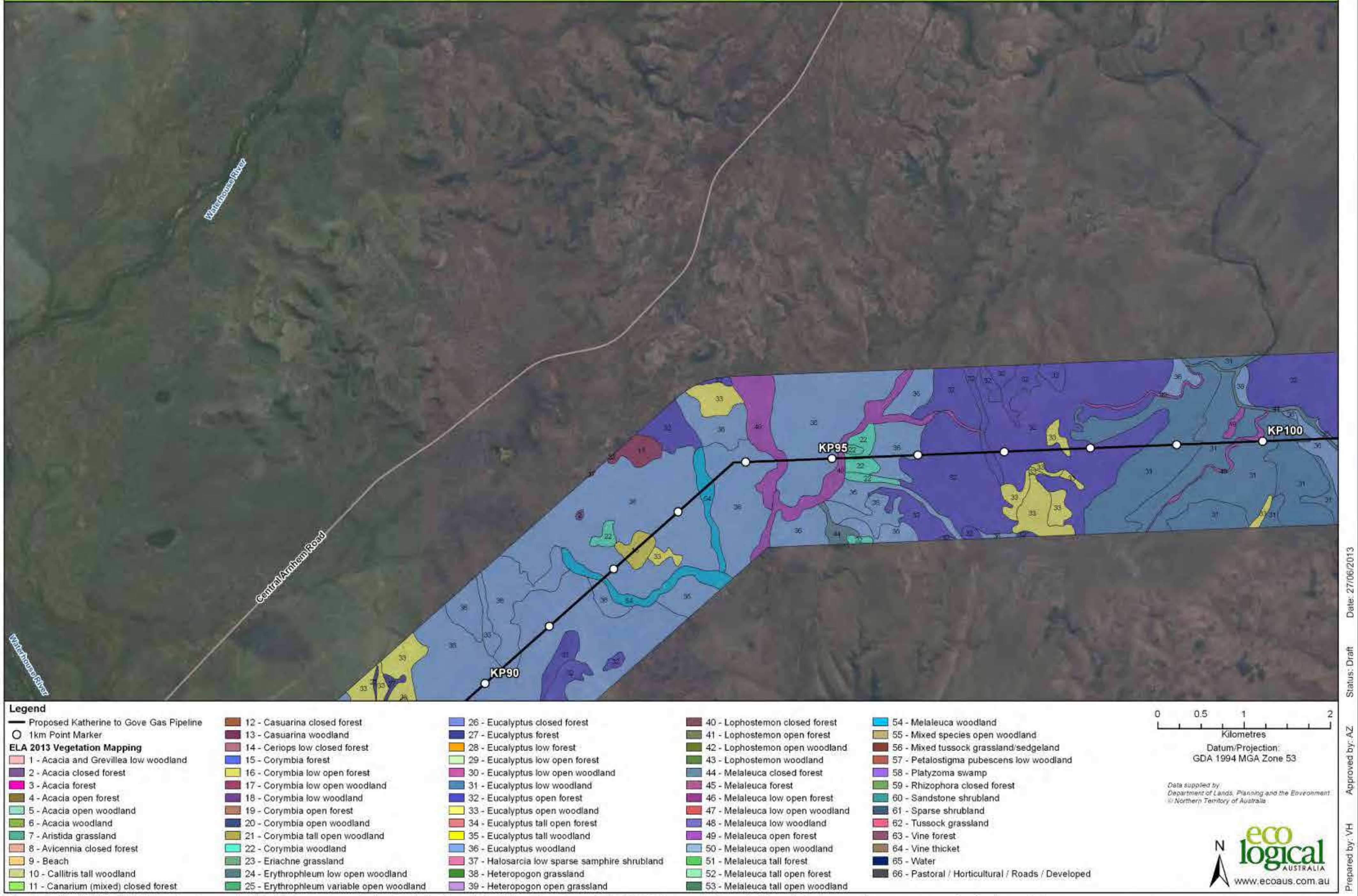
ELA Vegetation Mapping

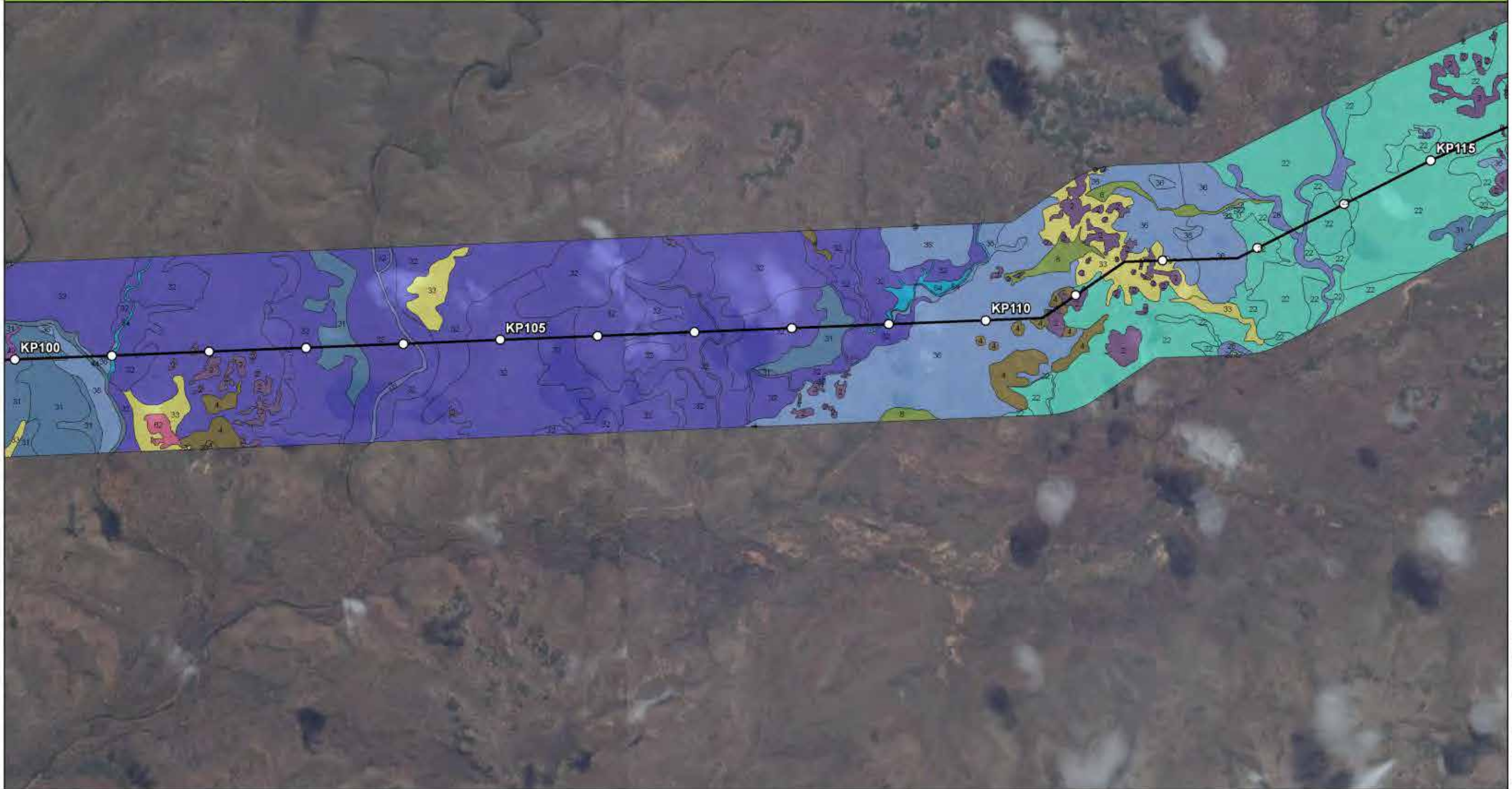
Tile 8



Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 9



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
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23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
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34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
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38 - Heteropogon grassland
39 - Heteropogon open grassland
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42 - Lophostemon open woodland
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44 - Melaleuca closed forest
45 - Melaleuca forest
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47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
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64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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ELA Vegetation Mapping

Tile 10

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
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9 - Beach
10 - Callitris tall woodland
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12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
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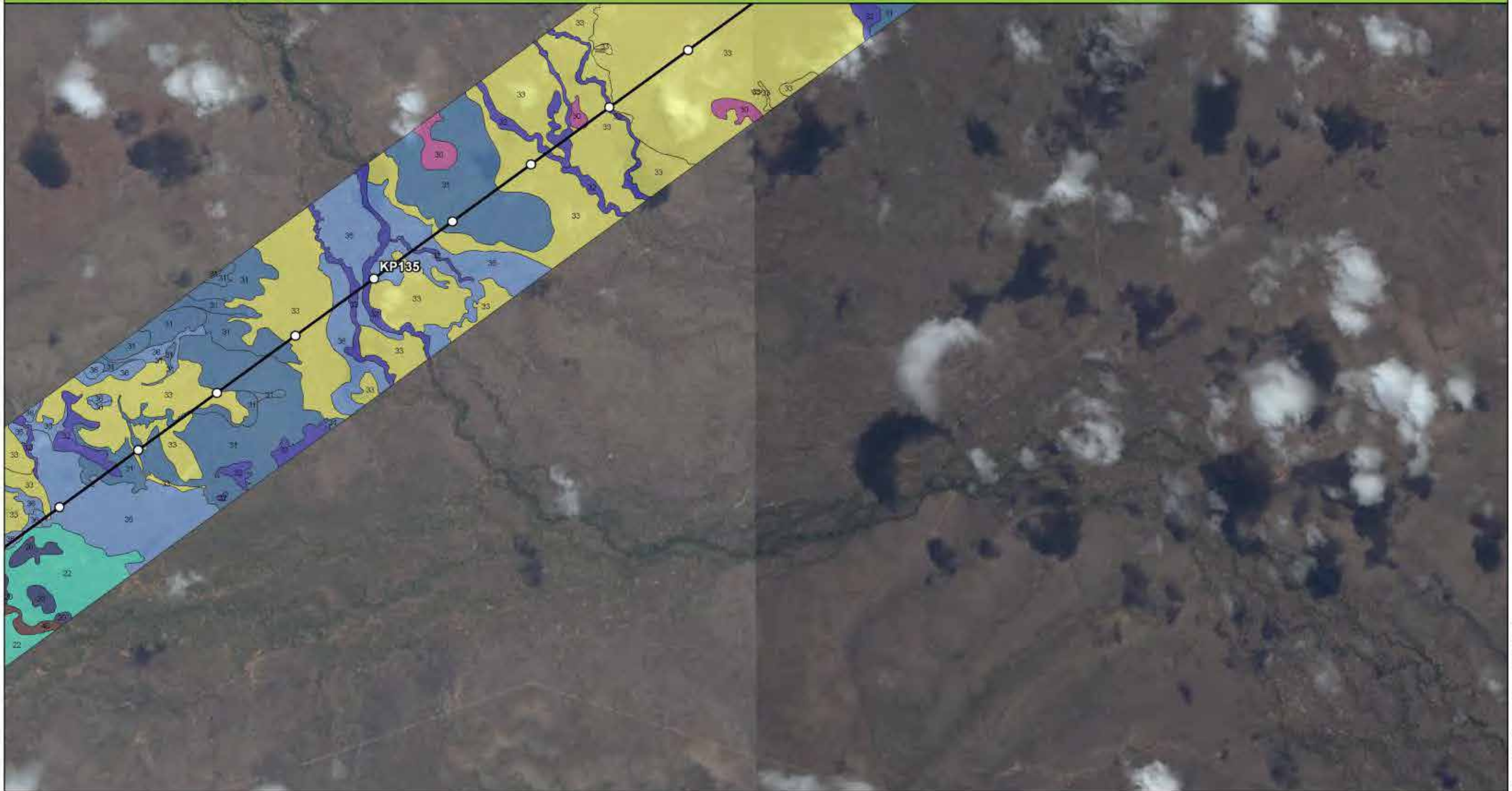
ELA Vegetation Mapping

Tile 11



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
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9 - Beach
10 - Callitris tall woodland
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13 - Casuarina woodland
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17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
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53 - Melaleuca tall open woodland
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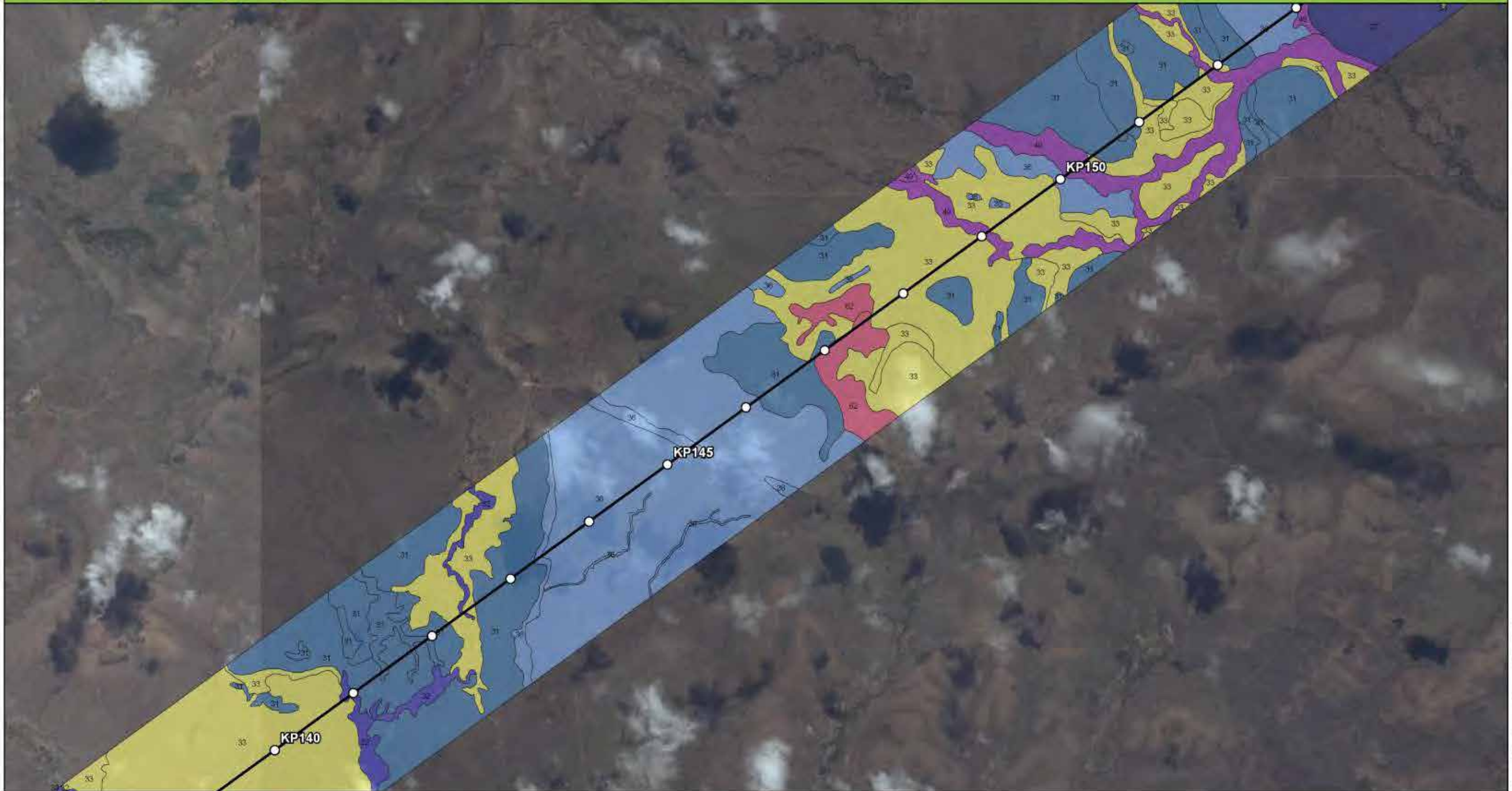
ELA Vegetation Mapping

Tile 12



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
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- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
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- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
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- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
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- 56 - Mixed tussock grassland/sedgeland
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- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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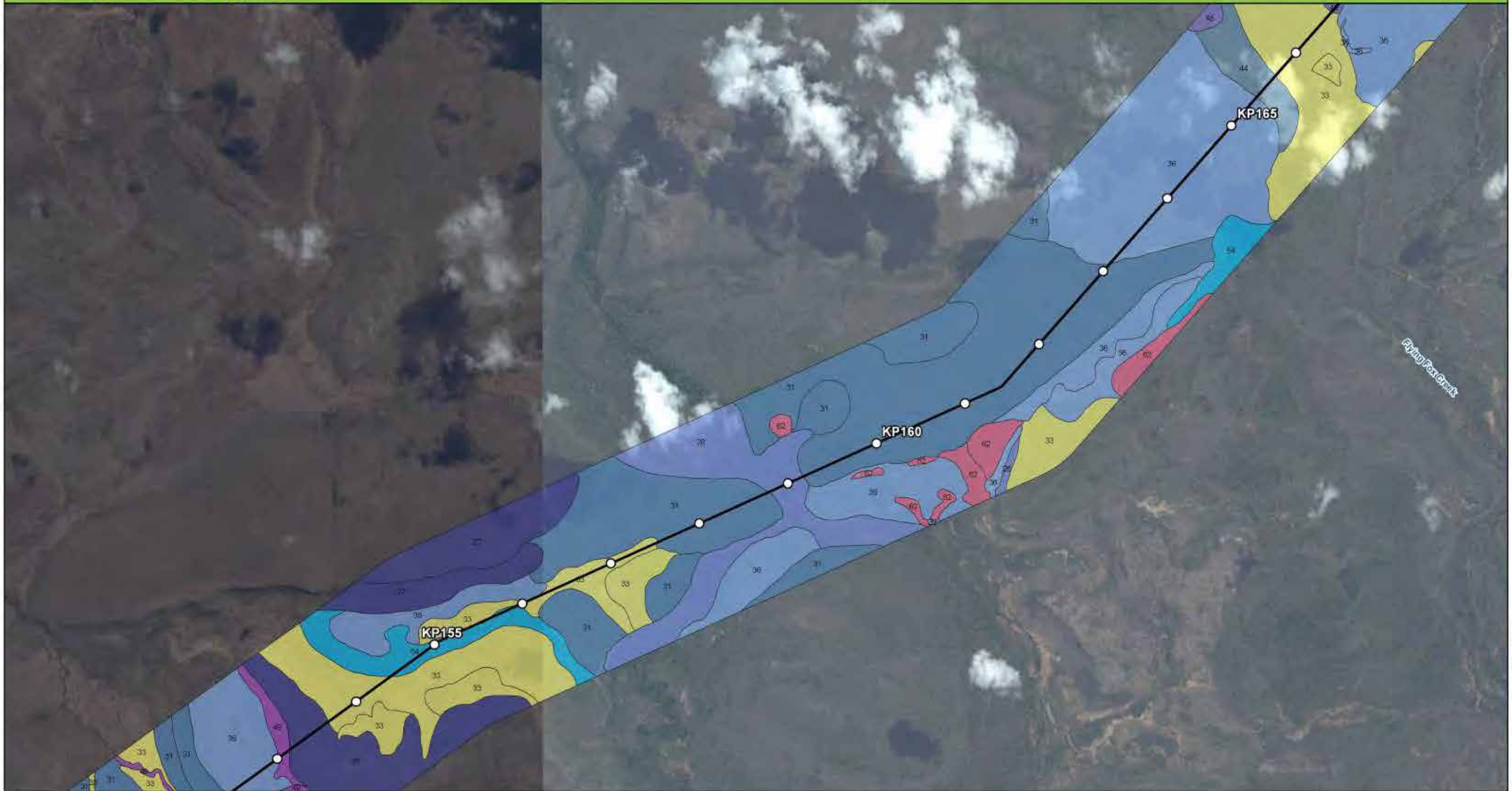
ELA Vegetation Mapping

Tile 13



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
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- 30 - Eucalyptus low open woodland
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- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

Datum/Projection:
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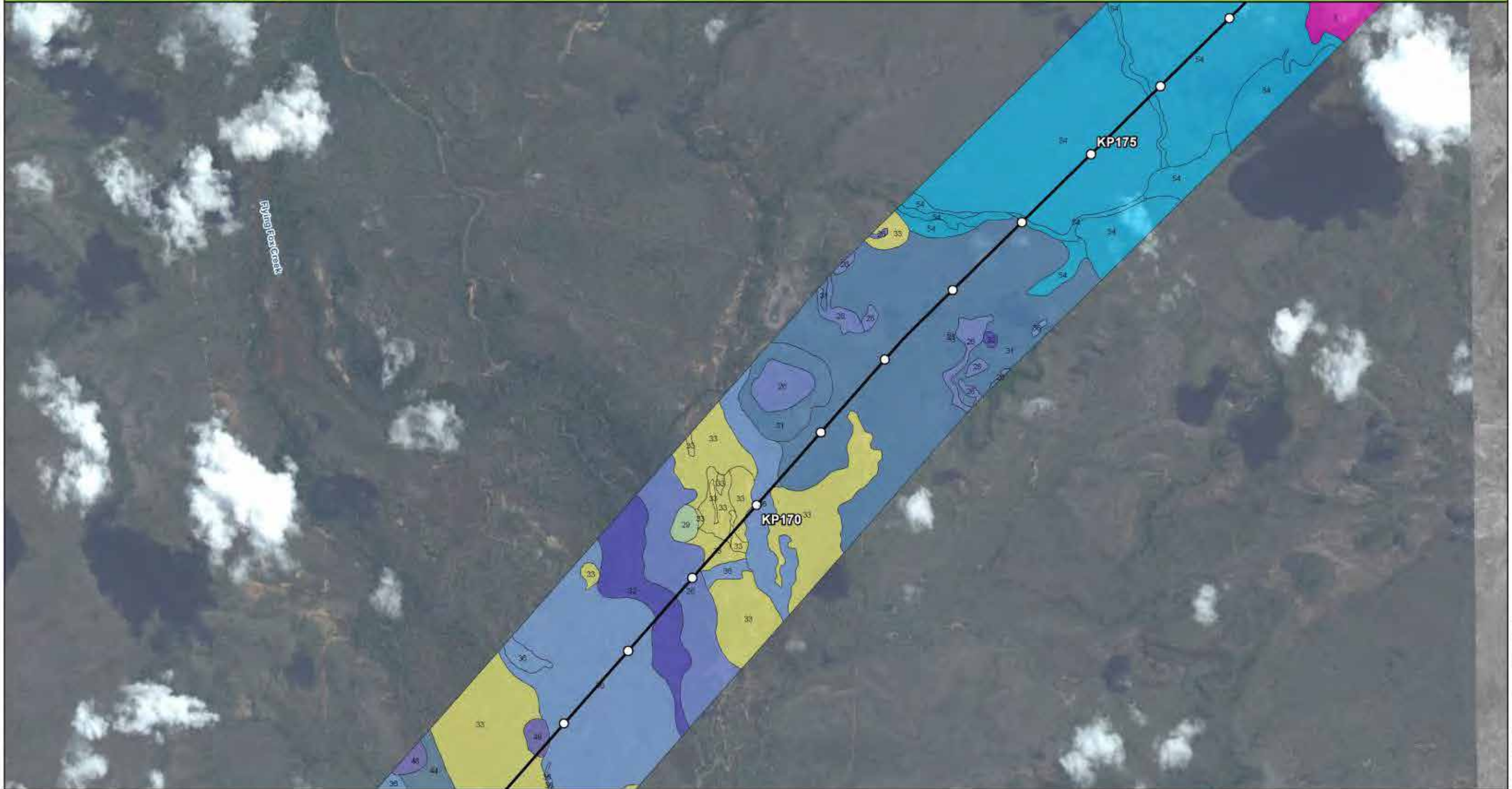
Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 14



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
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53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
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64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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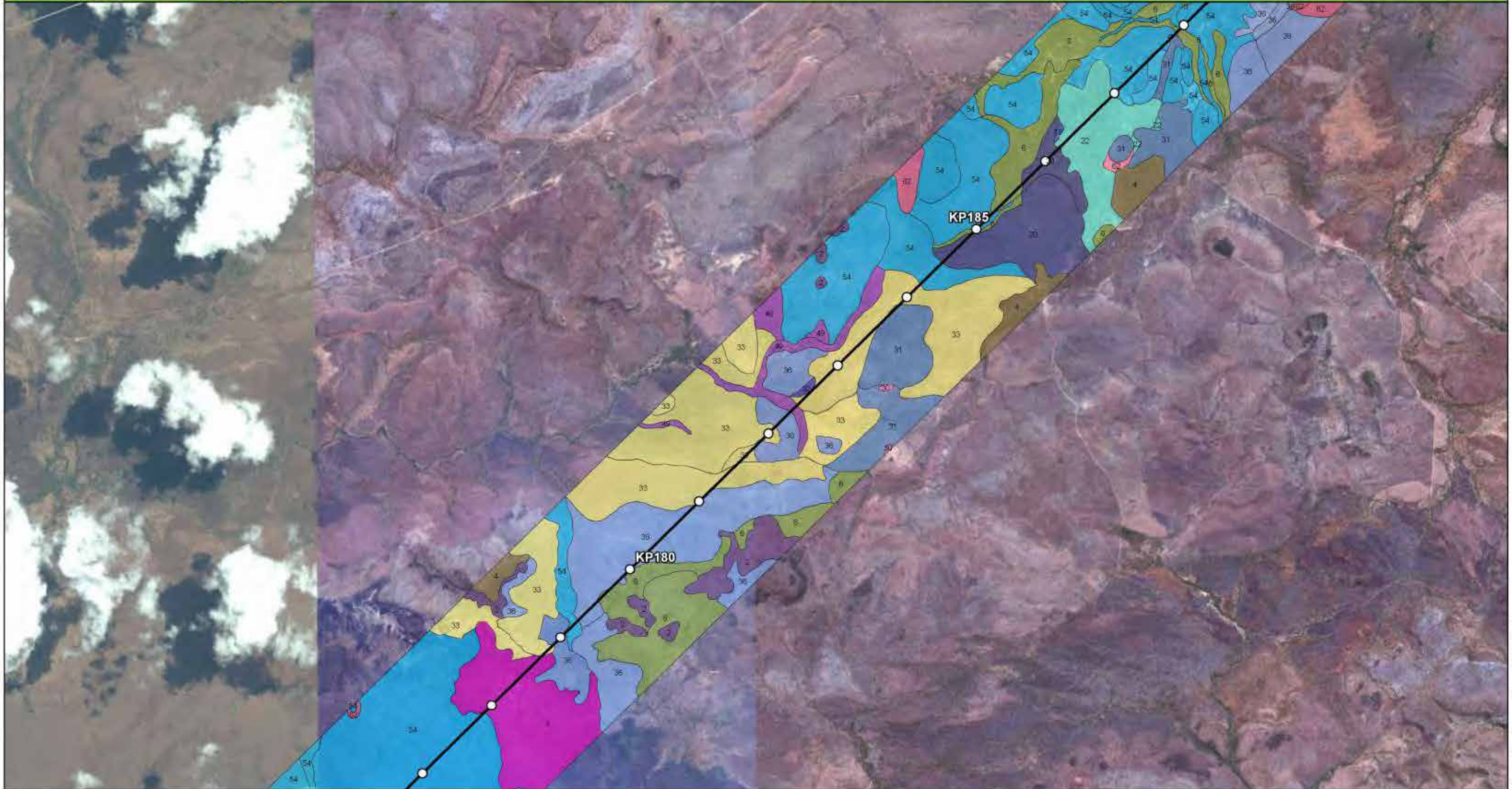
ELA Vegetation Mapping

Tile 15



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2

Kilometres

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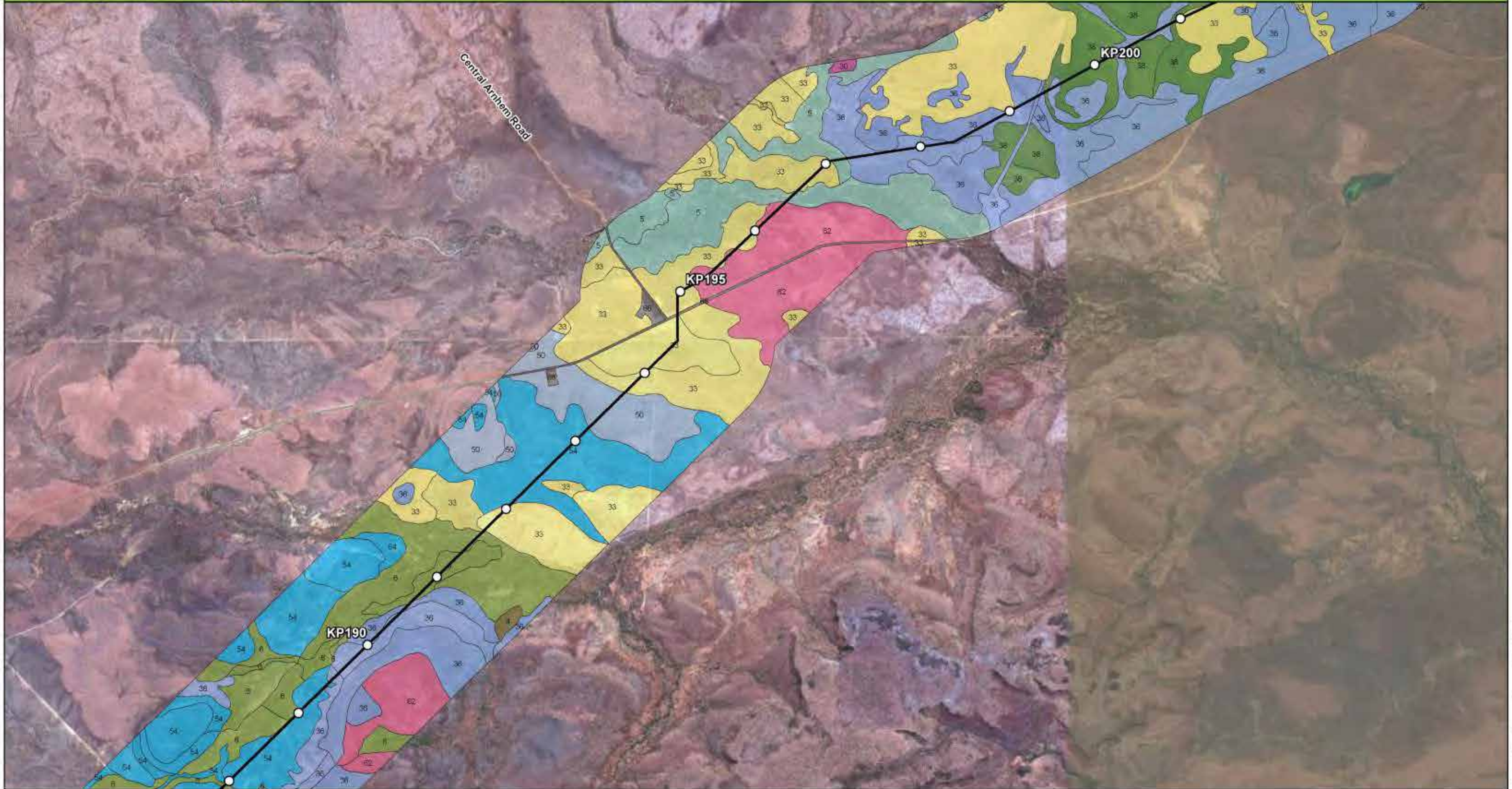
ELA Vegetation Mapping

Tile 16



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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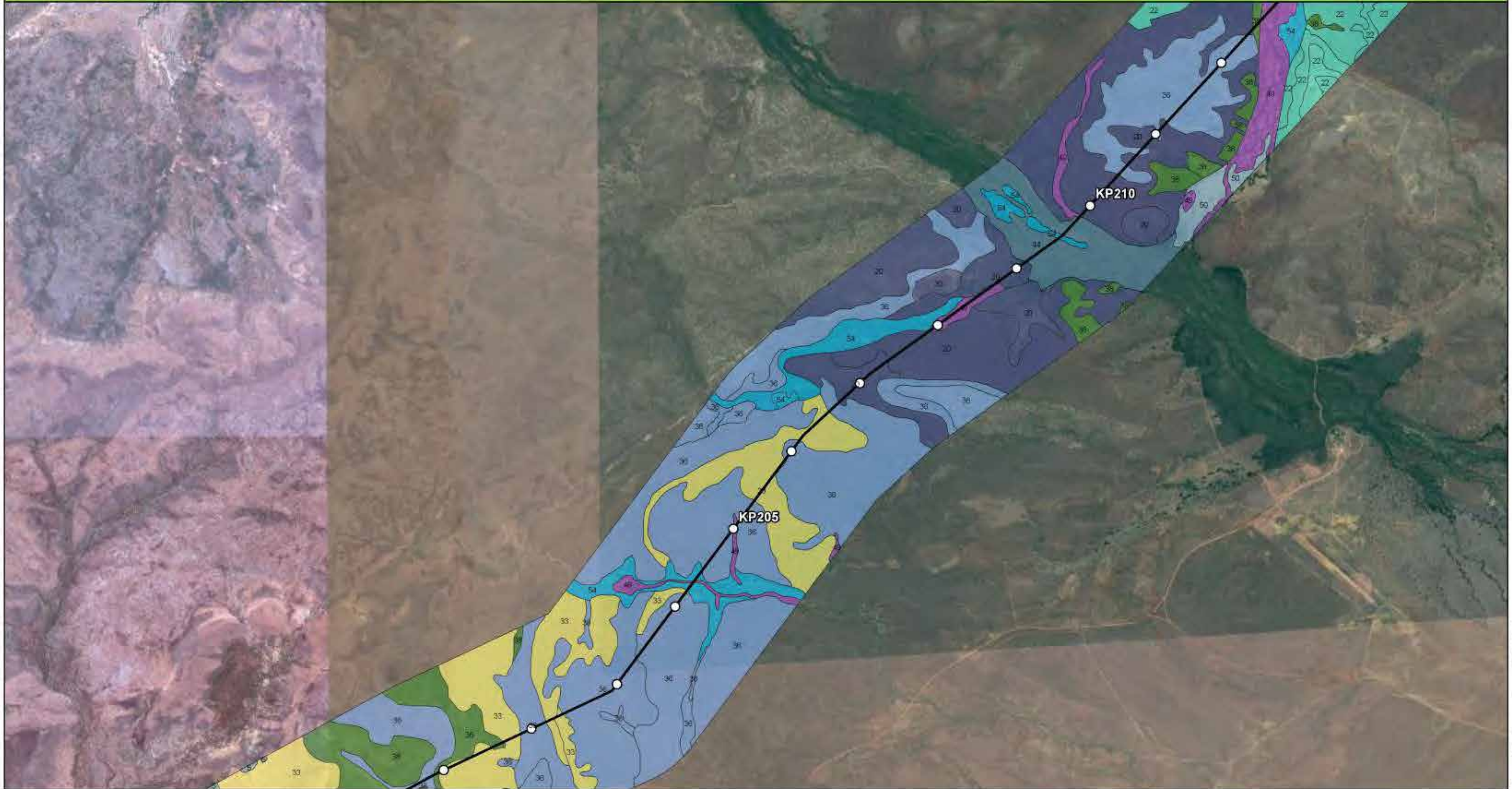
ELA Vegetation Mapping

Tile 17



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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ELA Vegetation Mapping

Tile 18

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
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- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
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- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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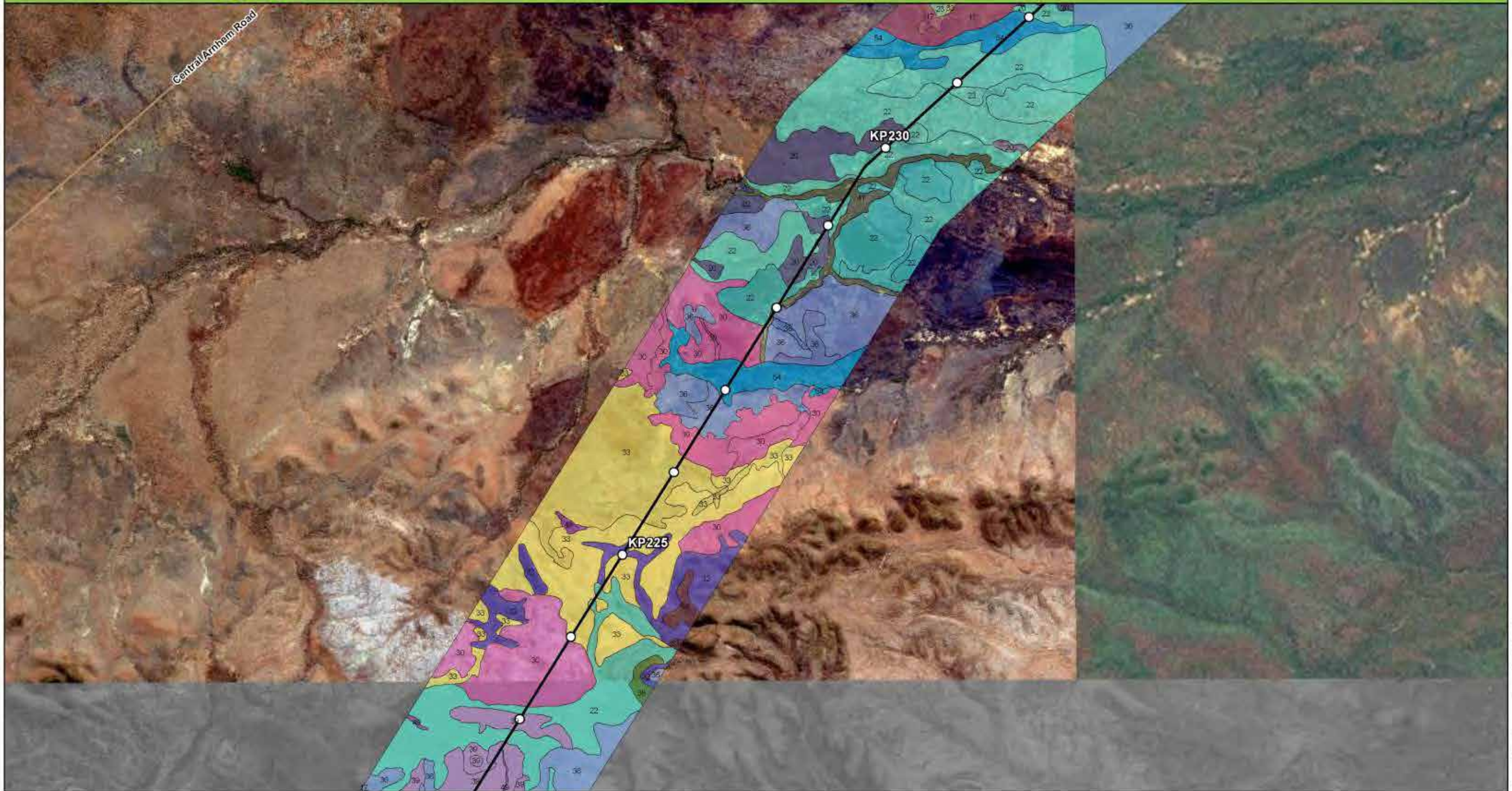
ELA Vegetation Mapping

Tile 19



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
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- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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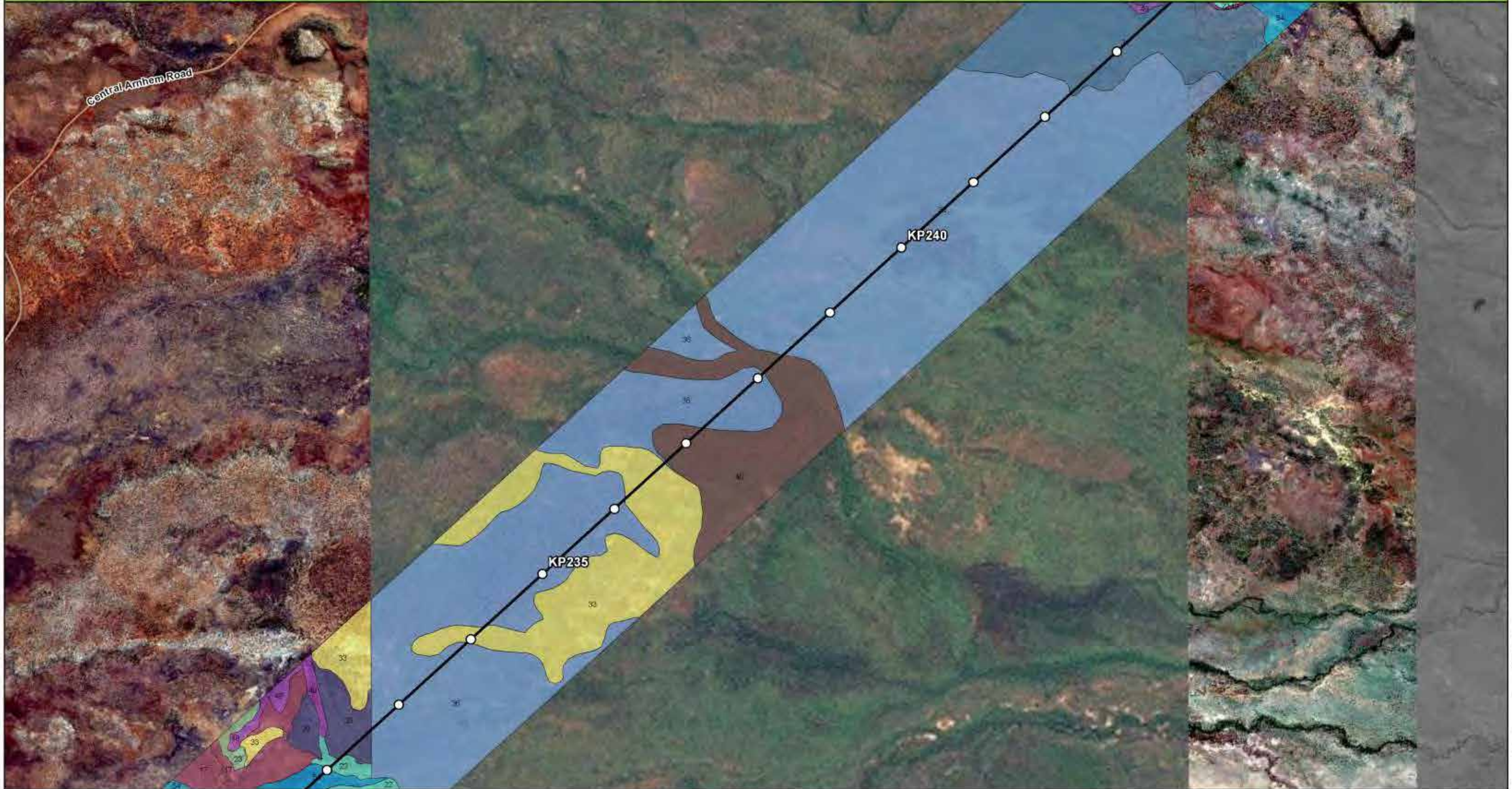
ELA Vegetation Mapping

Tile 20



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
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- 22 - Corymbia woodland
- 23 - Eriachne grassland
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- 25 - Erythrophleum variable open woodland
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- 28 - Eucalyptus low forest
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- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
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- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
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- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
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- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
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- 51 - Melaleuca tall forest
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- 53 - Melaleuca tall open woodland
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- 63 - Vine forest
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- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

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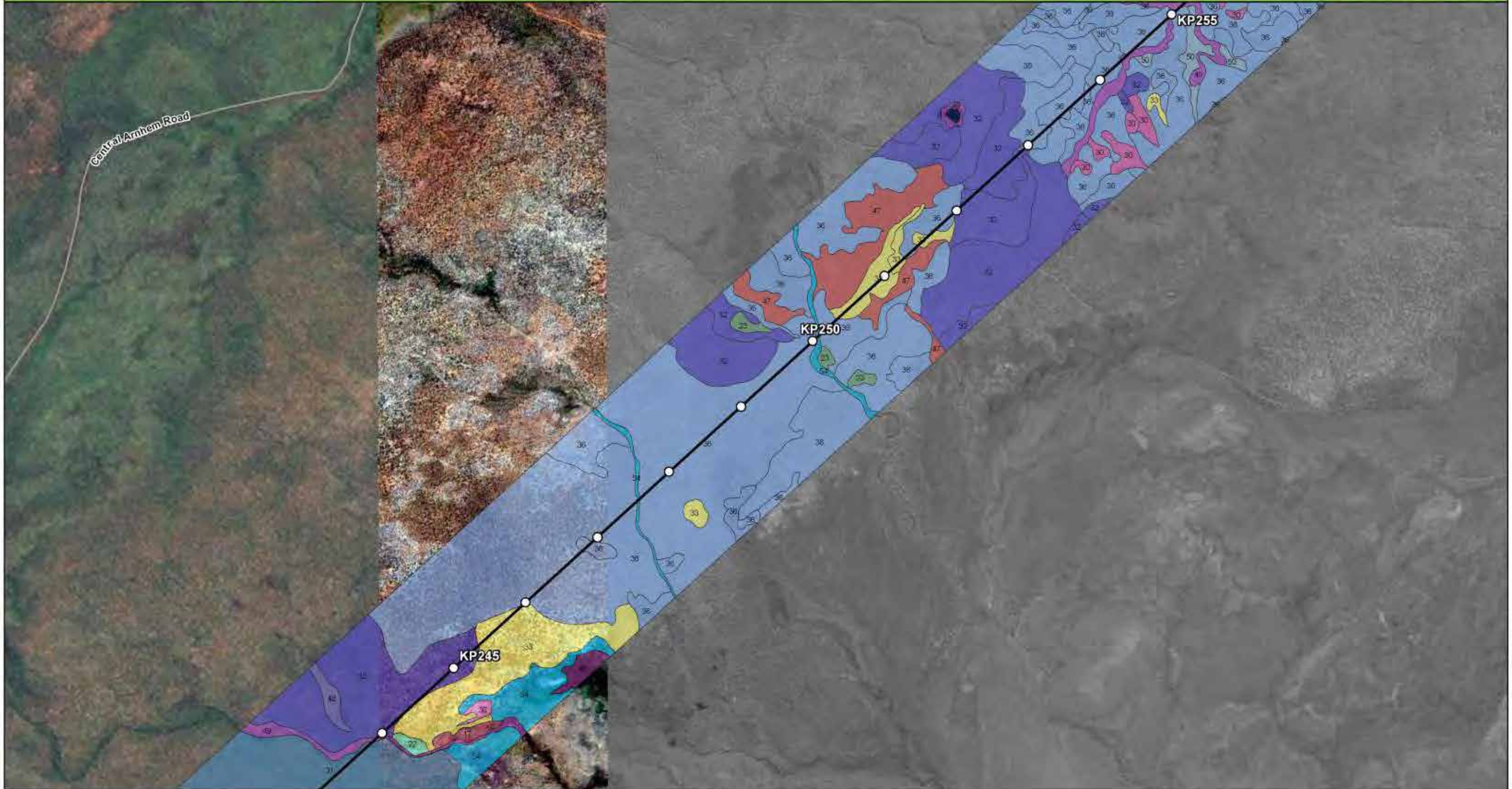
ELA Vegetation Mapping

Tile 21



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
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6 - Acacia woodland
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17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
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24 - Erythrophleum low open woodland
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27 - Eucalyptus forest
28 - Eucalyptus low forest
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31 - Eucalyptus low woodland
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33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
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38 - Heteropogon grassland
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44 - Melaleuca closed forest
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47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
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0 0.5 1 2
Kilometres

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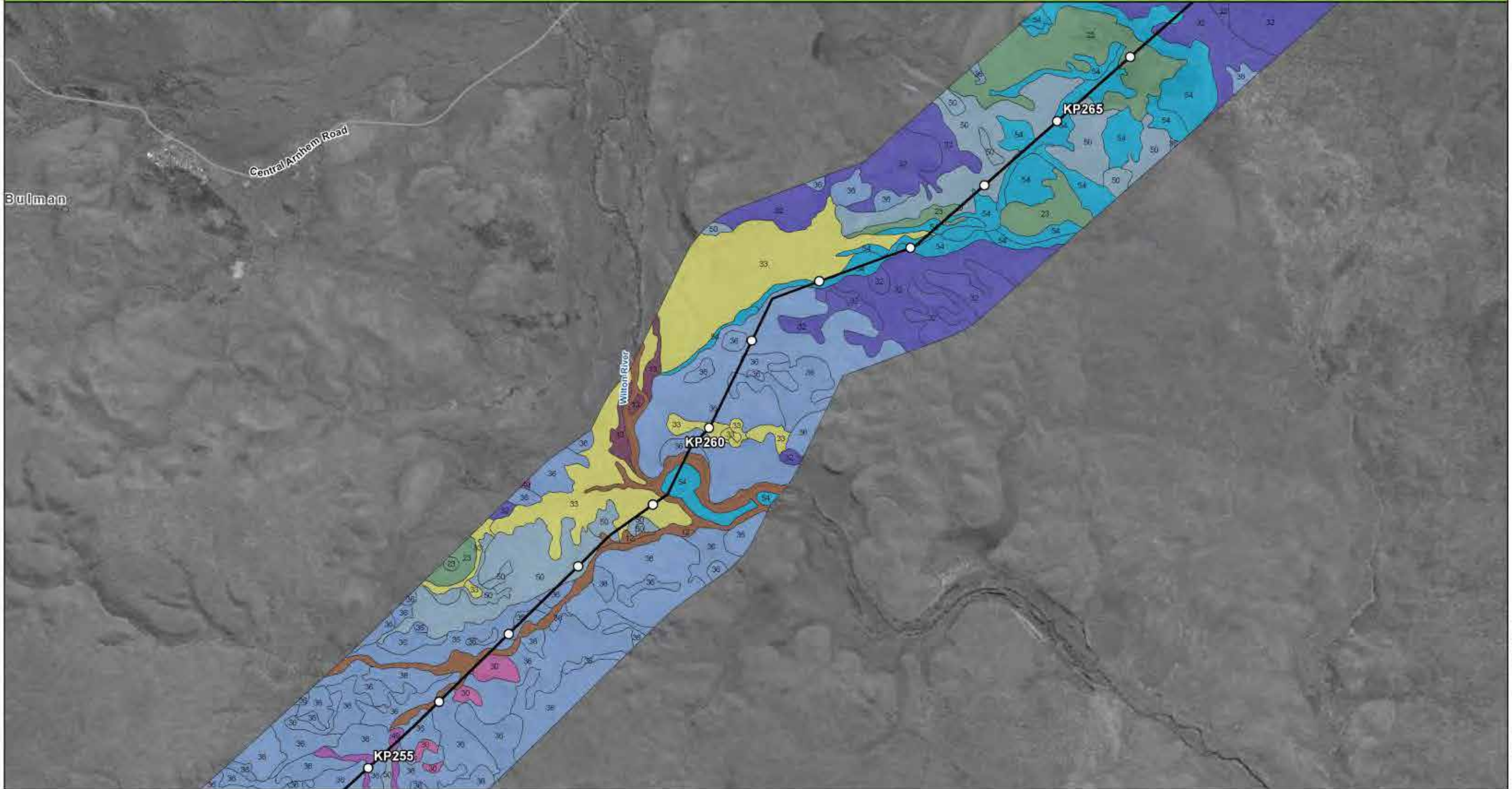
ELA Vegetation Mapping

Tile 22



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
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- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
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- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
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- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
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- 40 - Lophostemon closed forest
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- 49 - Melaleuca open forest
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- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
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- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
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- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

Datum/Projection:
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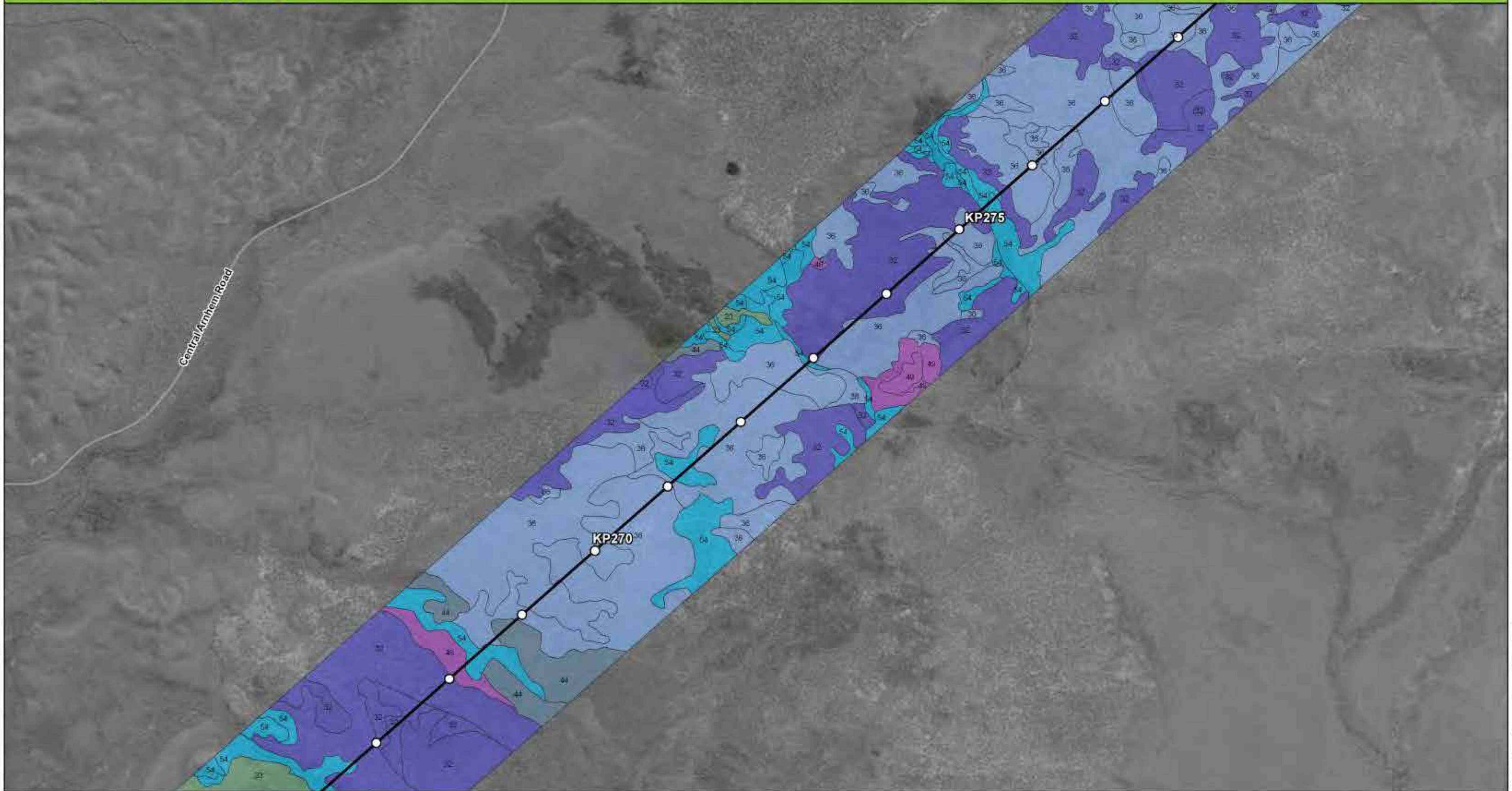
Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 23



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
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Kilometres

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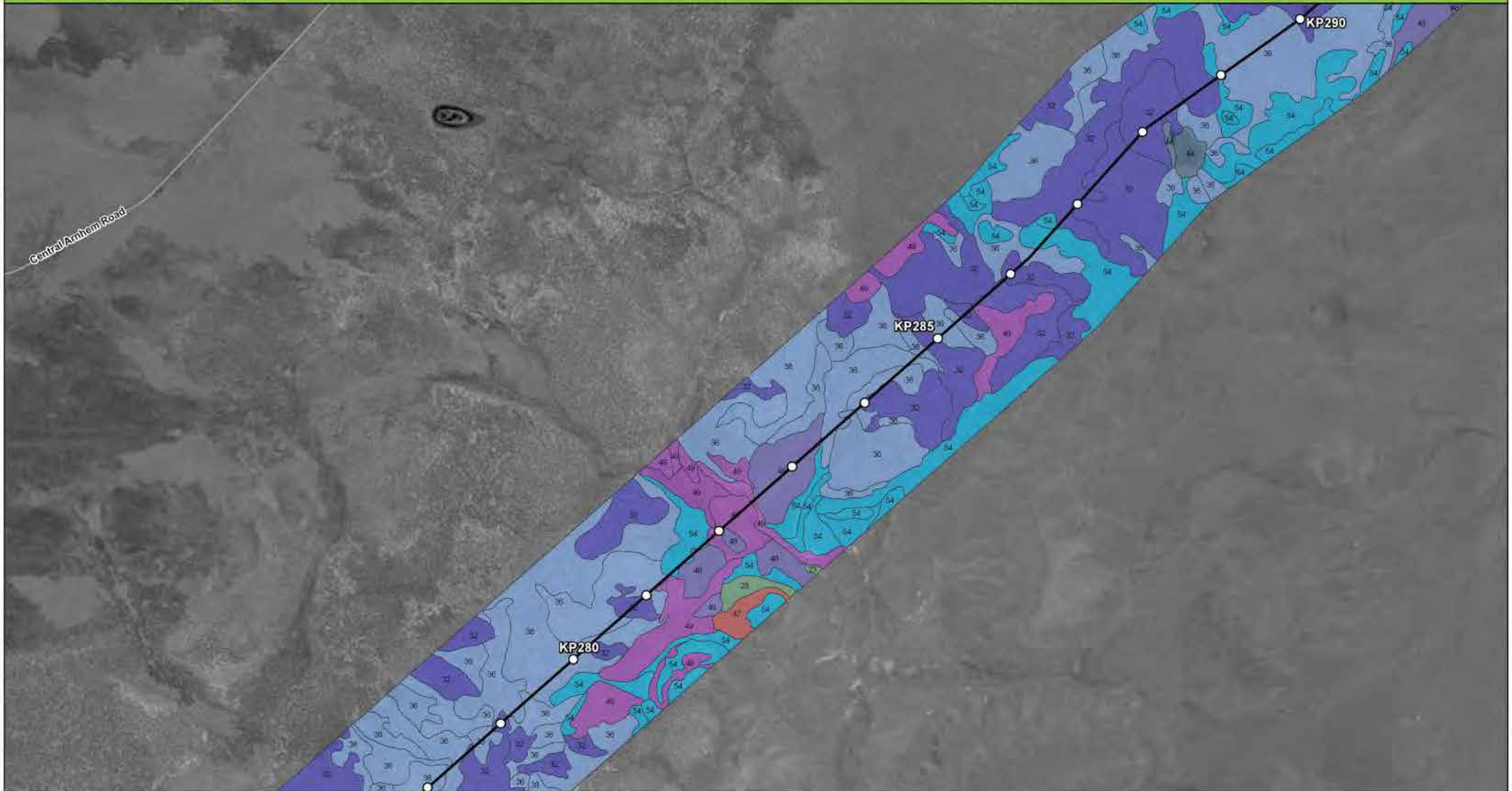
ELA Vegetation Mapping

Tile 24



Legend

— Proposed Katherine to Gove Gas Pipeline
○ 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
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ELA Vegetation Mapping

Tile 25

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
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- 3 - Acacia forest
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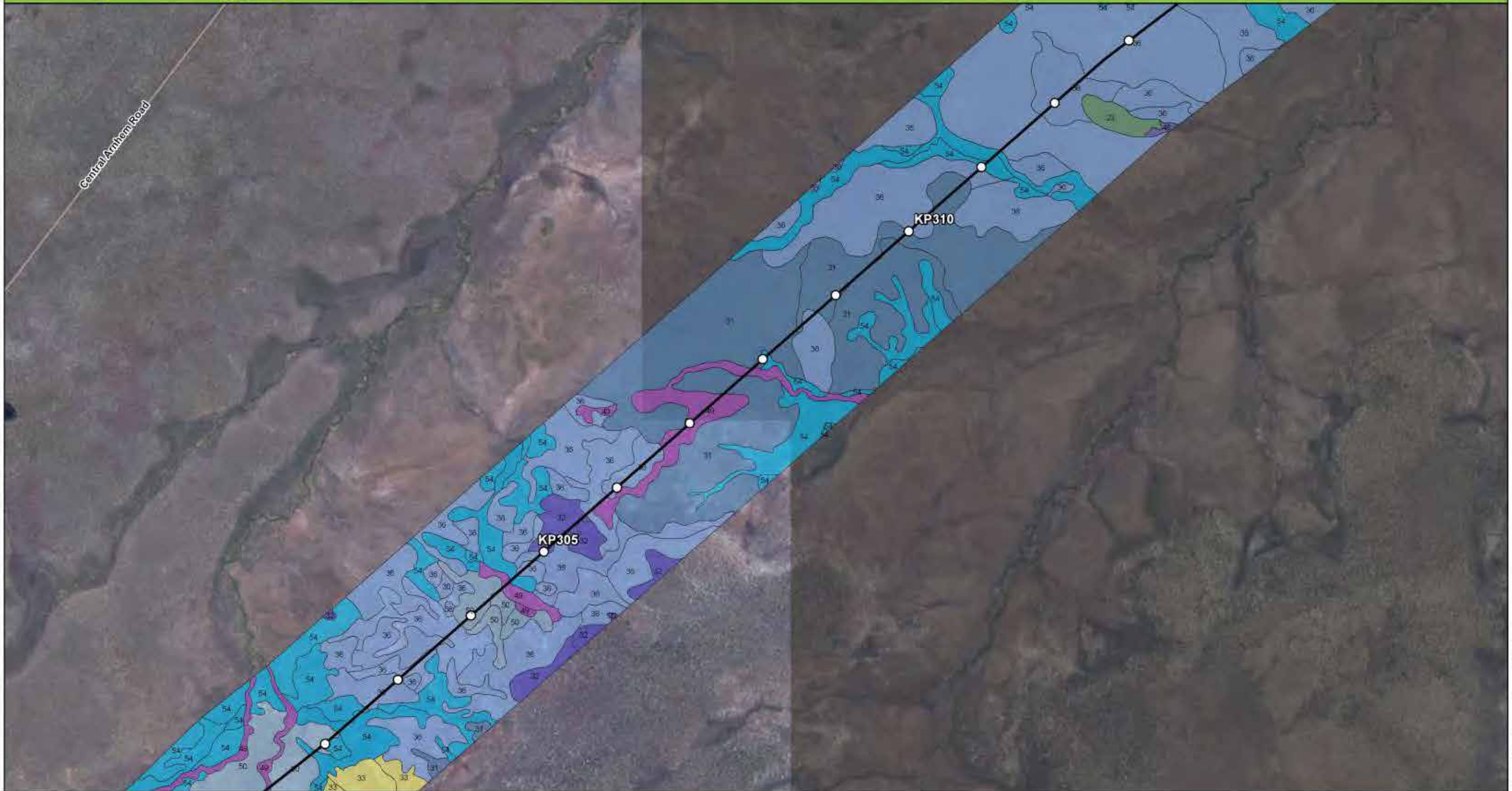
ELA Vegetation Mapping

Tile 26



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
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- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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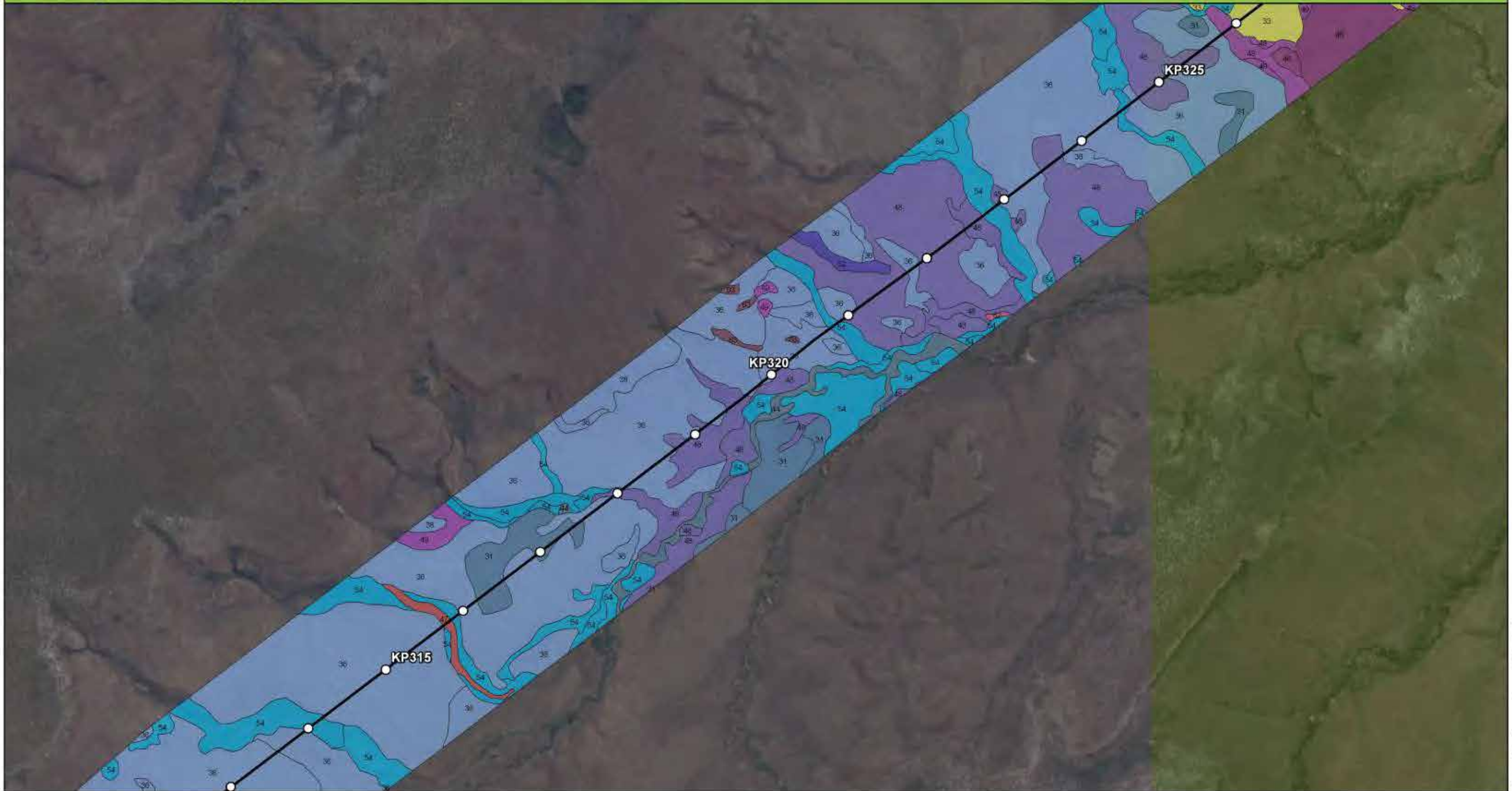
ELA Vegetation Mapping

Tile 27



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
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- 66 - Pastoral / Horticultural / Roads / Developed

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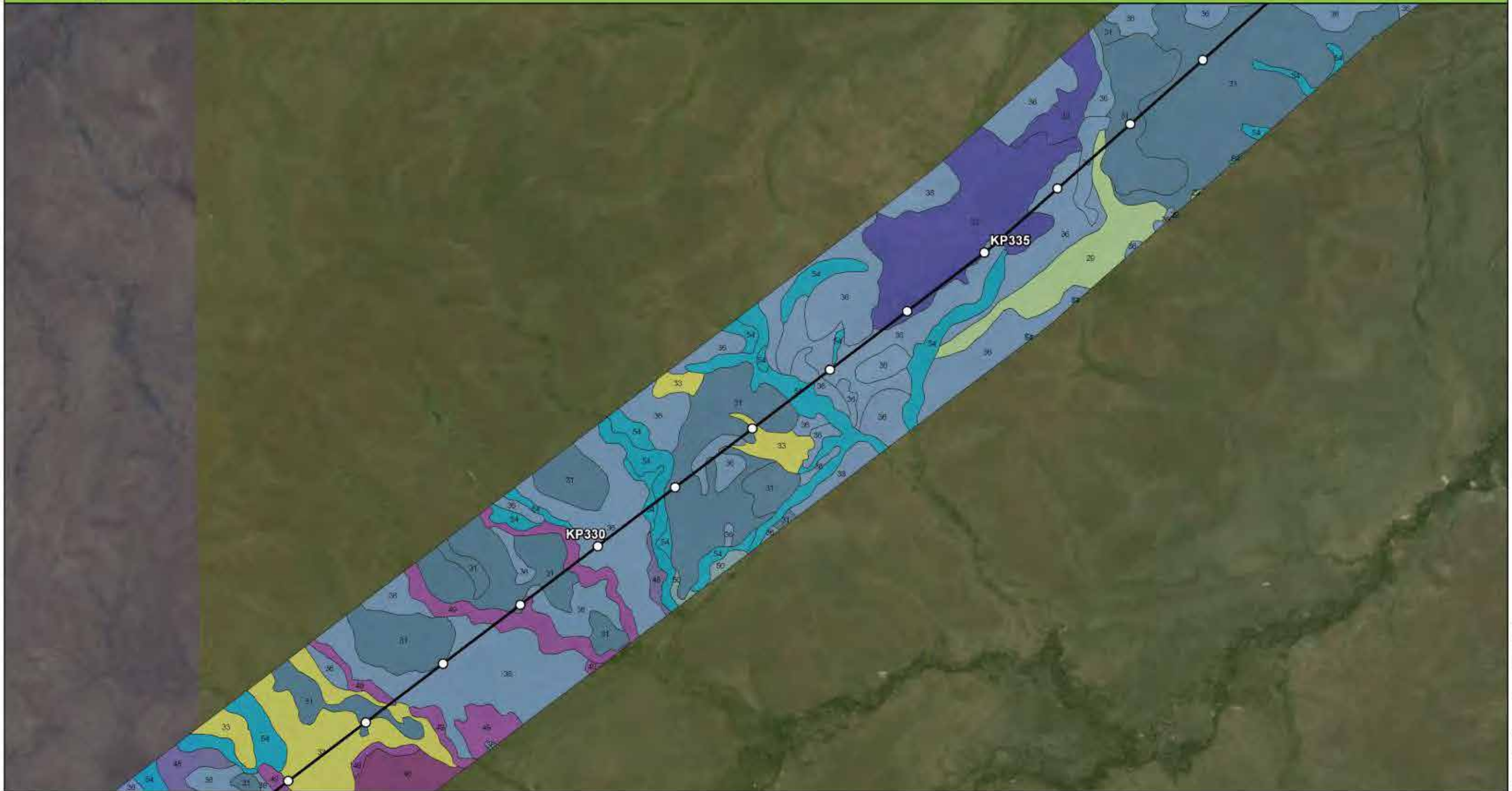
ELA Vegetation Mapping

Tile 28



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
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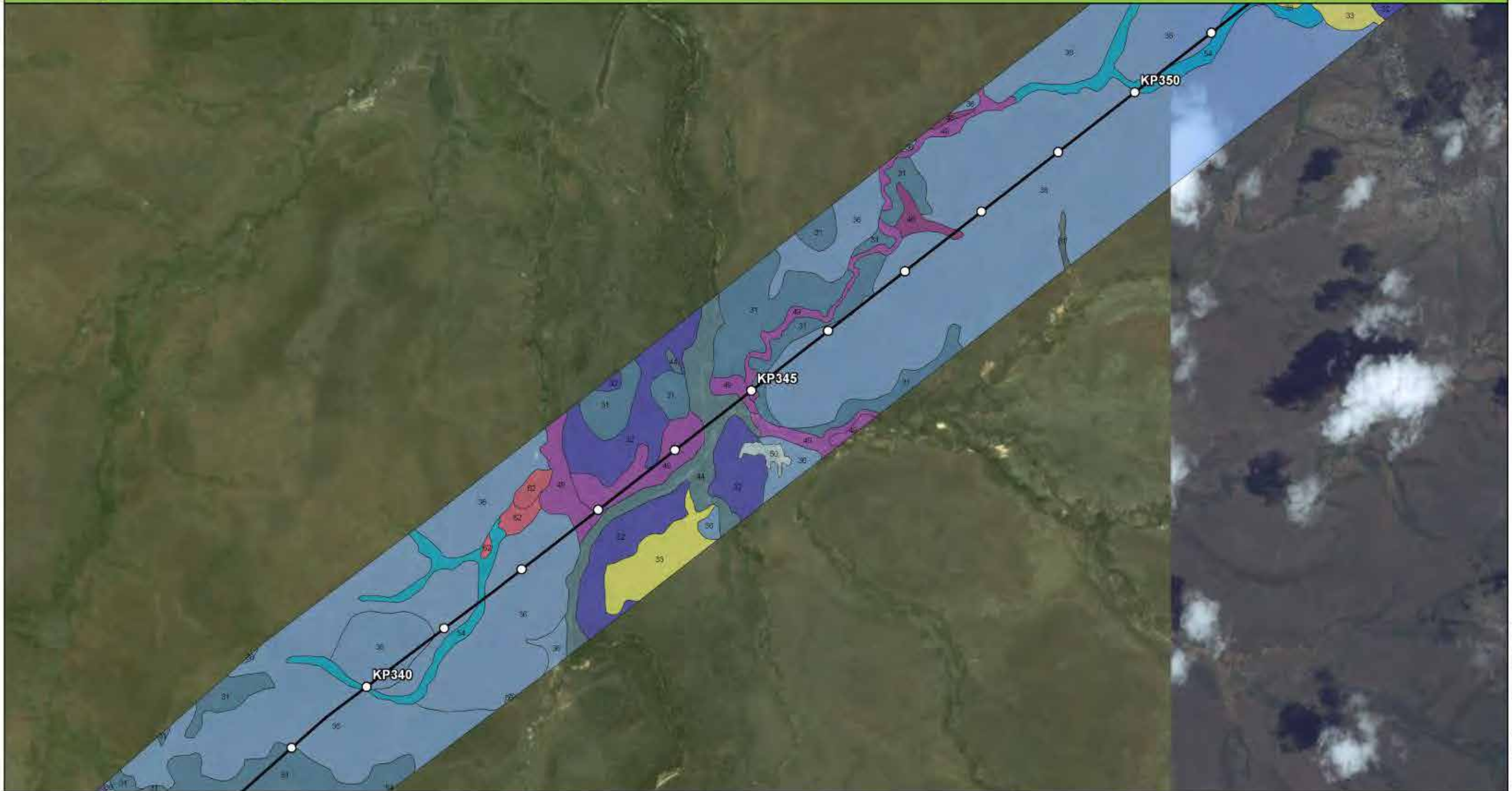
ELA Vegetation Mapping

Tile 29



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
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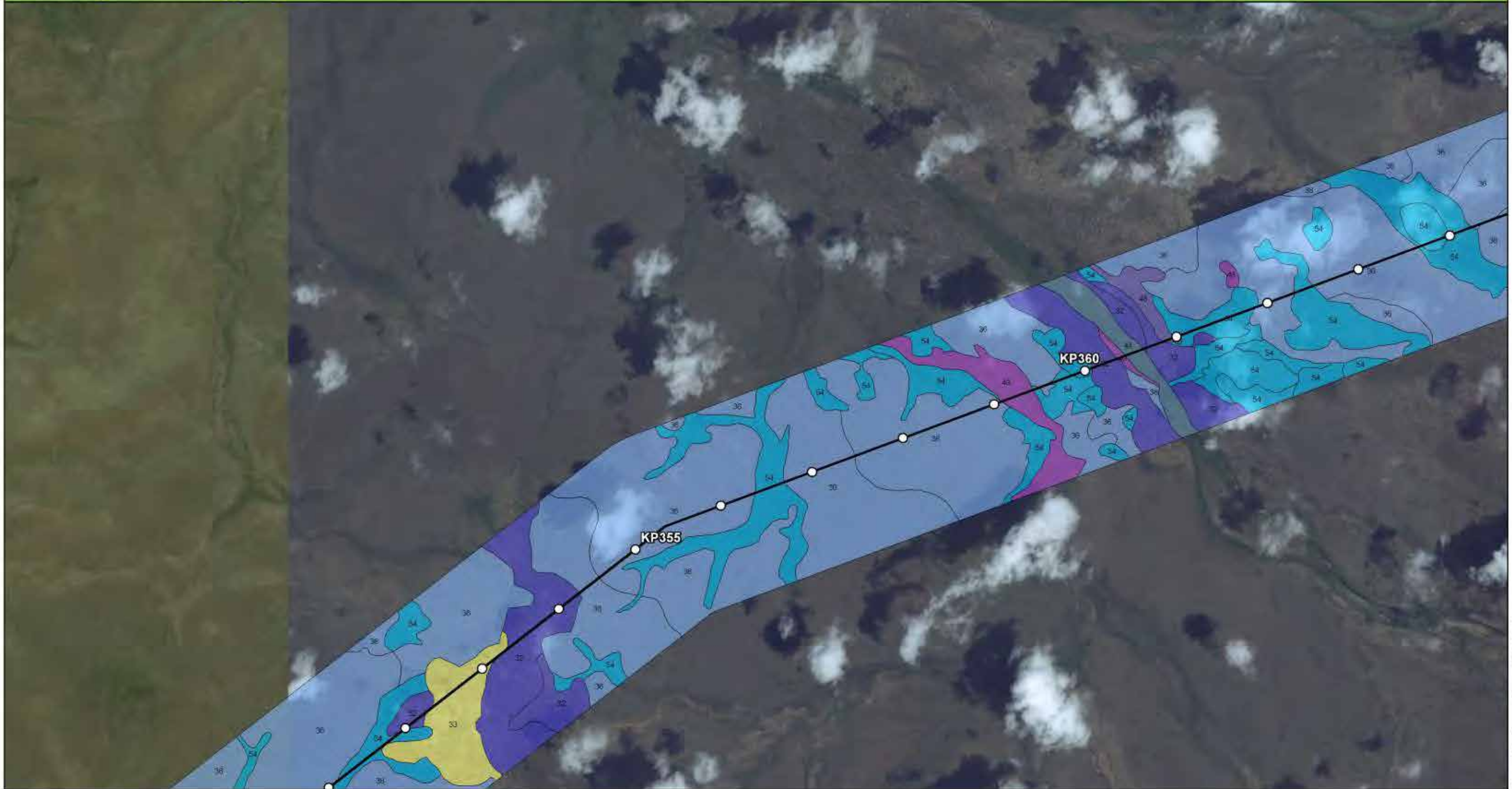
ELA Vegetation Mapping

Tile 30



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

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46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

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Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 31

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
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- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
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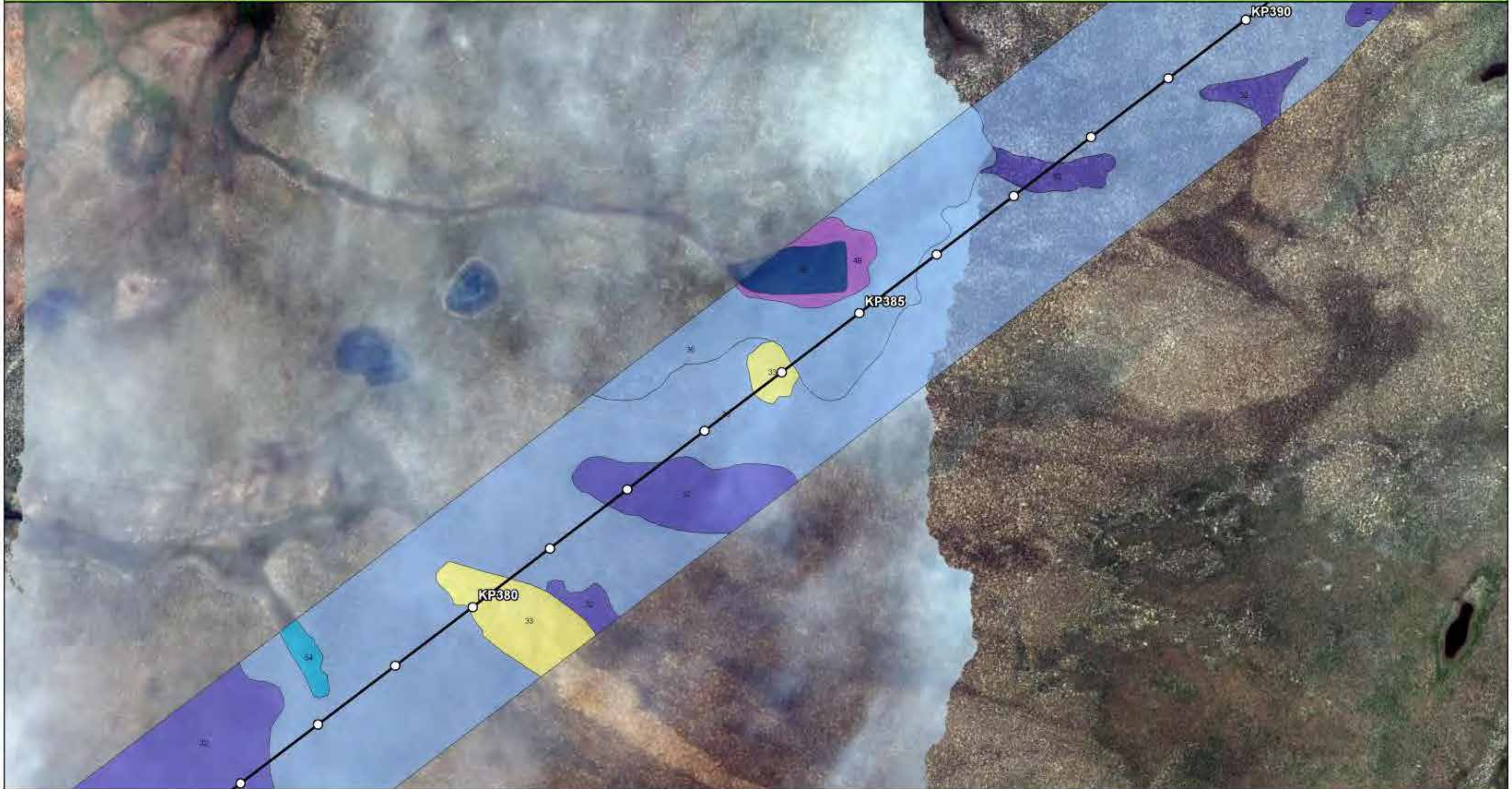
ELA Vegetation Mapping

Tile 32



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

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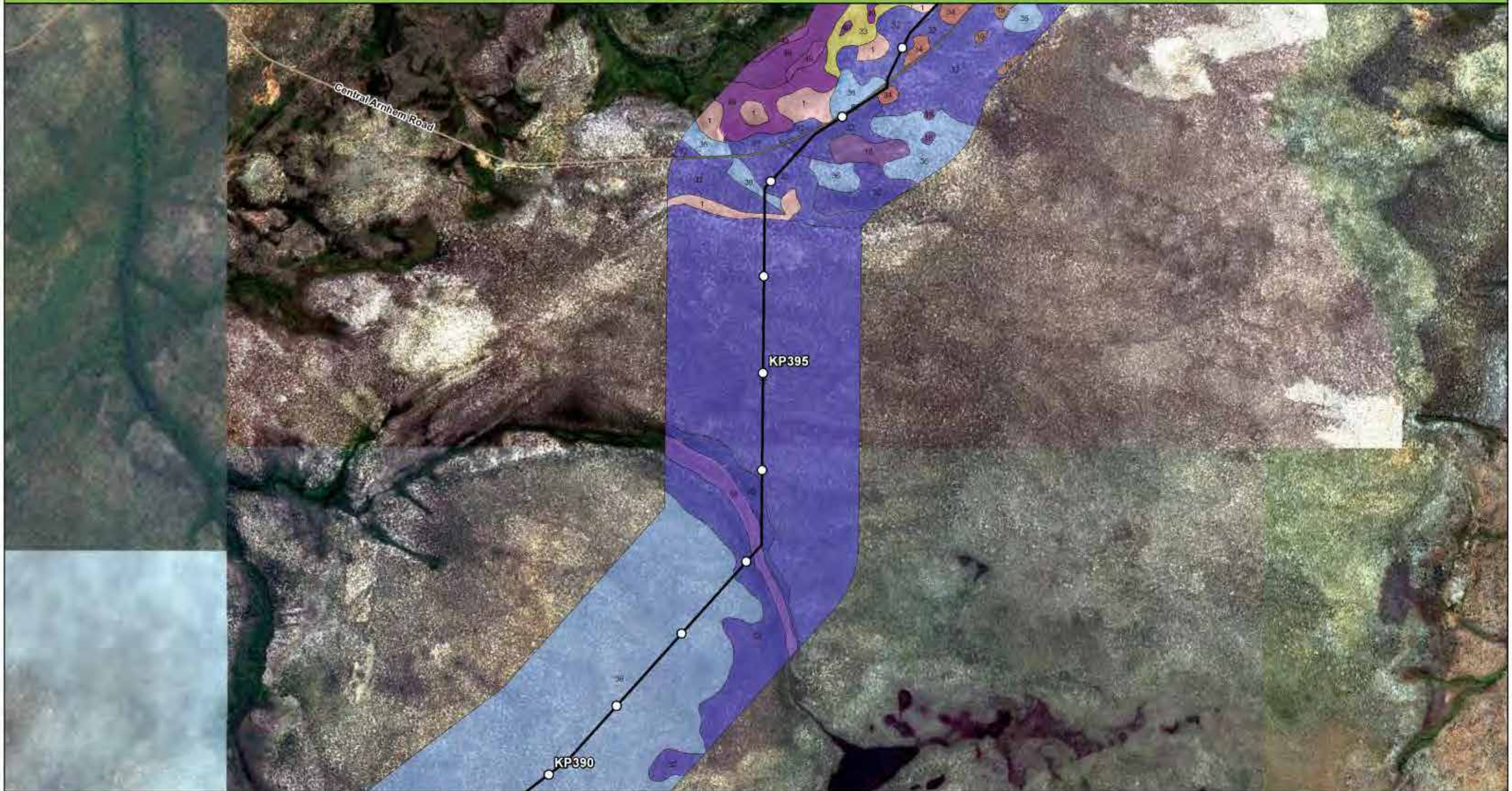
ELA Vegetation Mapping

Tile 33



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
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- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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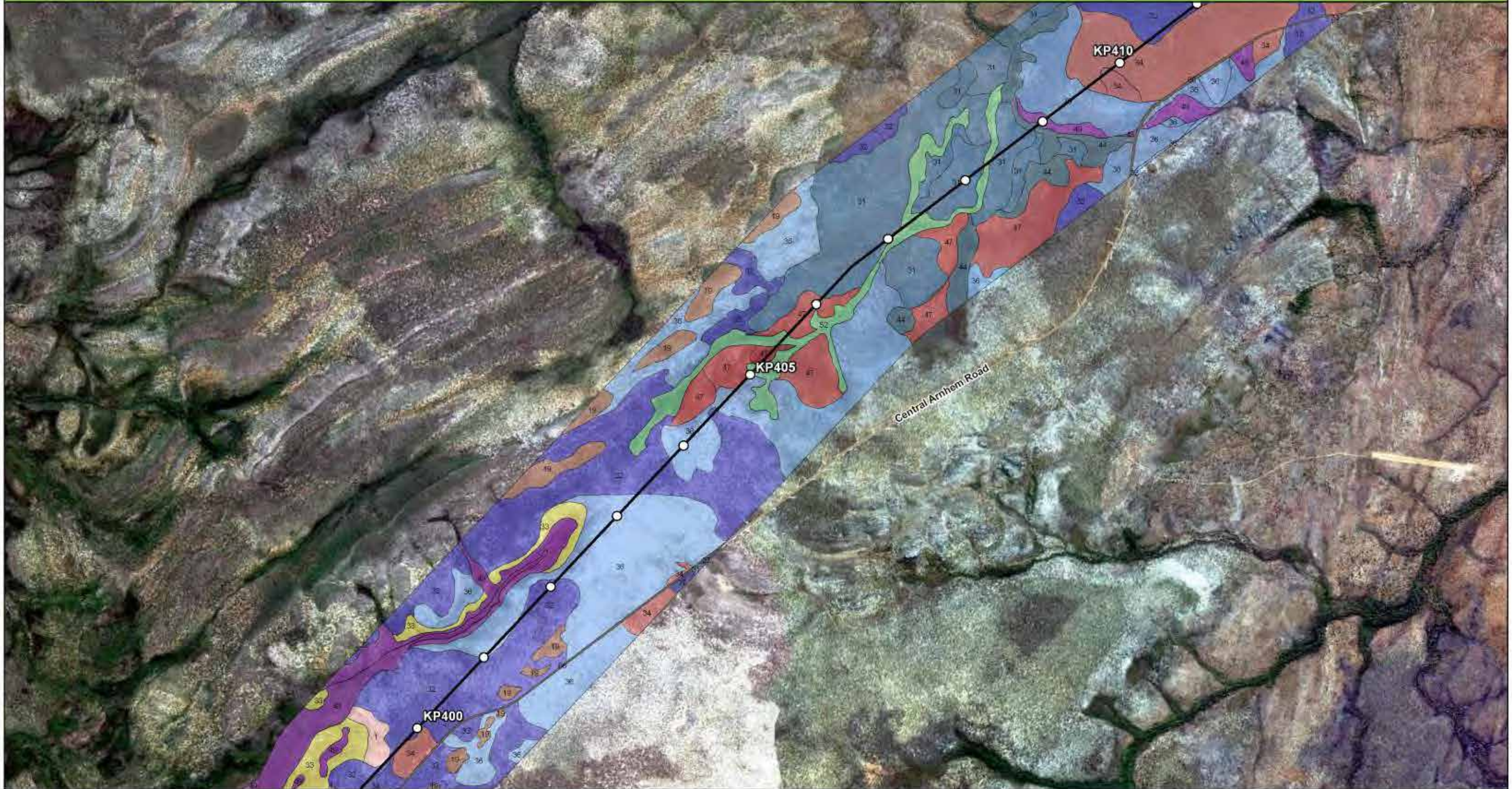
ELA Vegetation Mapping

Tile 34



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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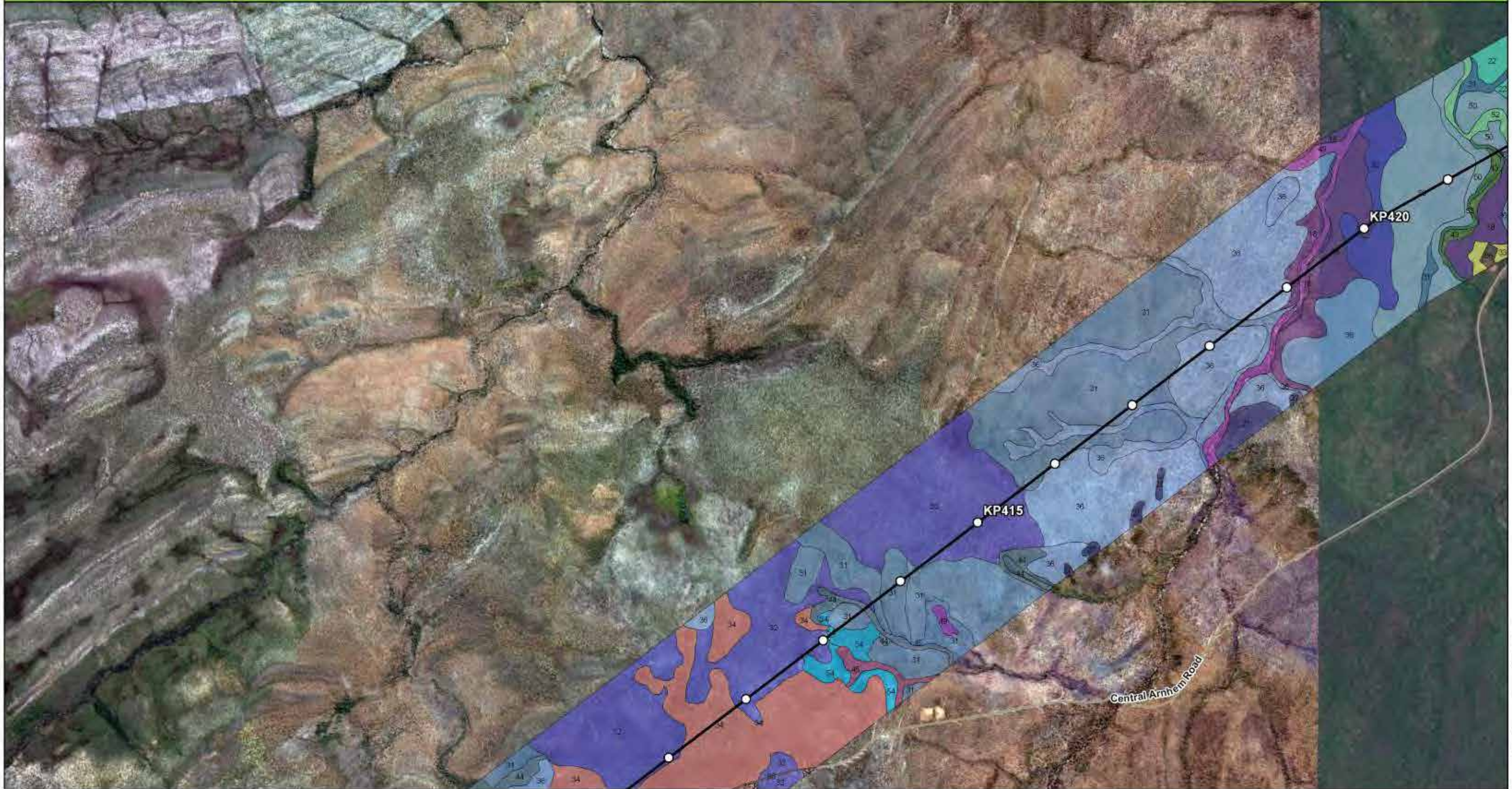
ELA Vegetation Mapping

Tile 35



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
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- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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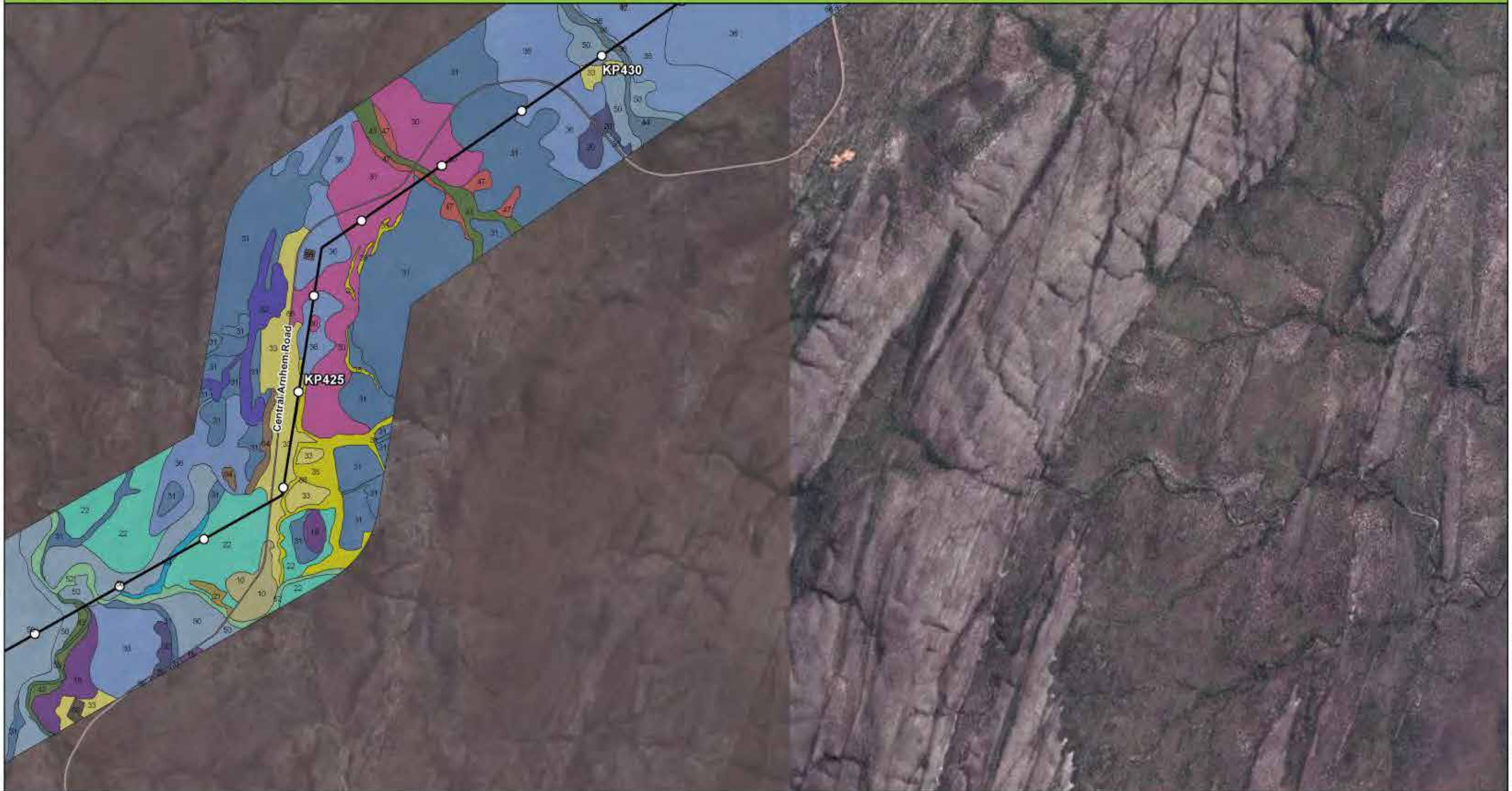
ELA Vegetation Mapping

Tile 36



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
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- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

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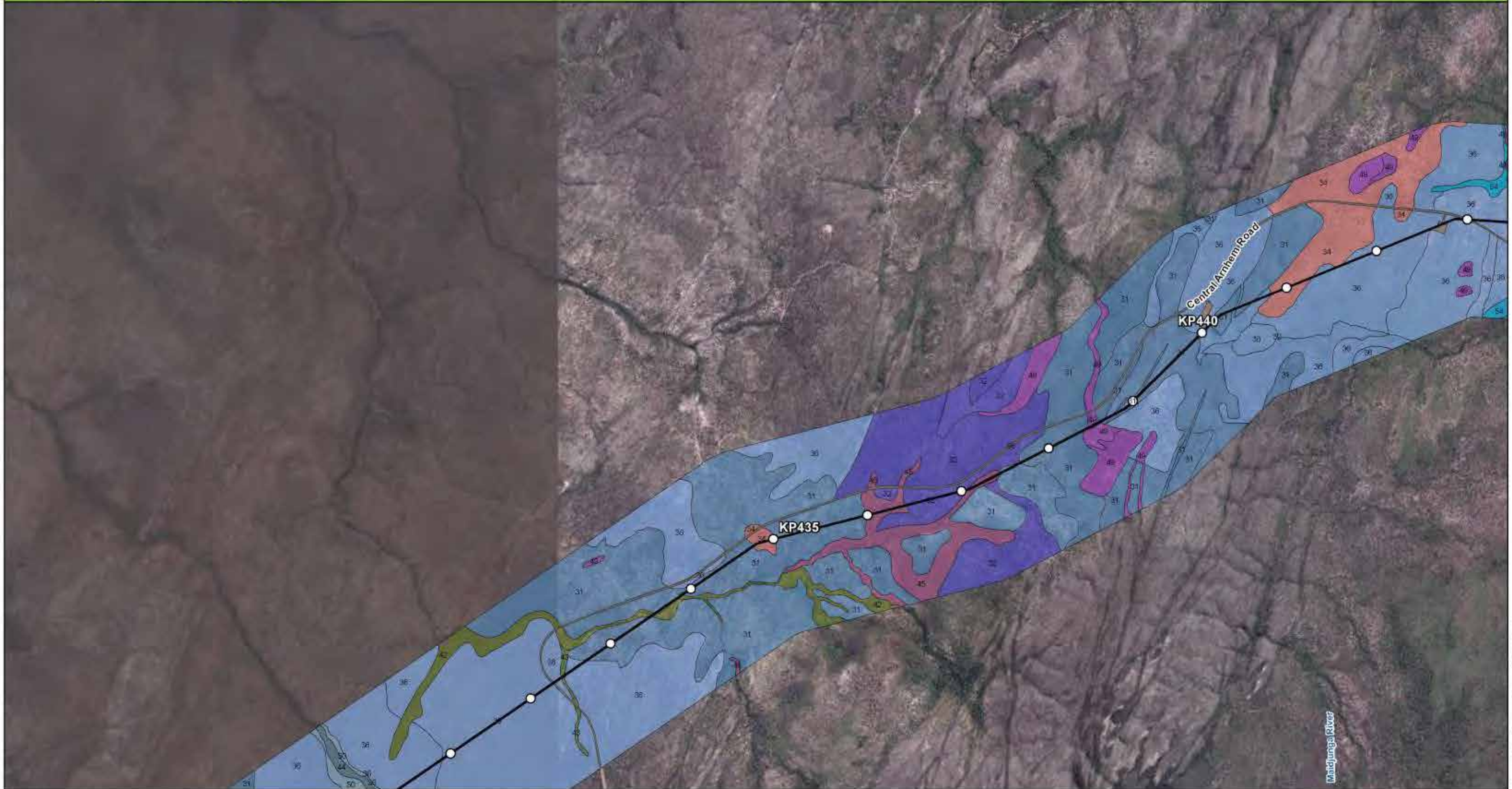
ELA Vegetation Mapping

Tile 37



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
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- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
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- 65 - Water
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0 0.5 1 2
Kilometres

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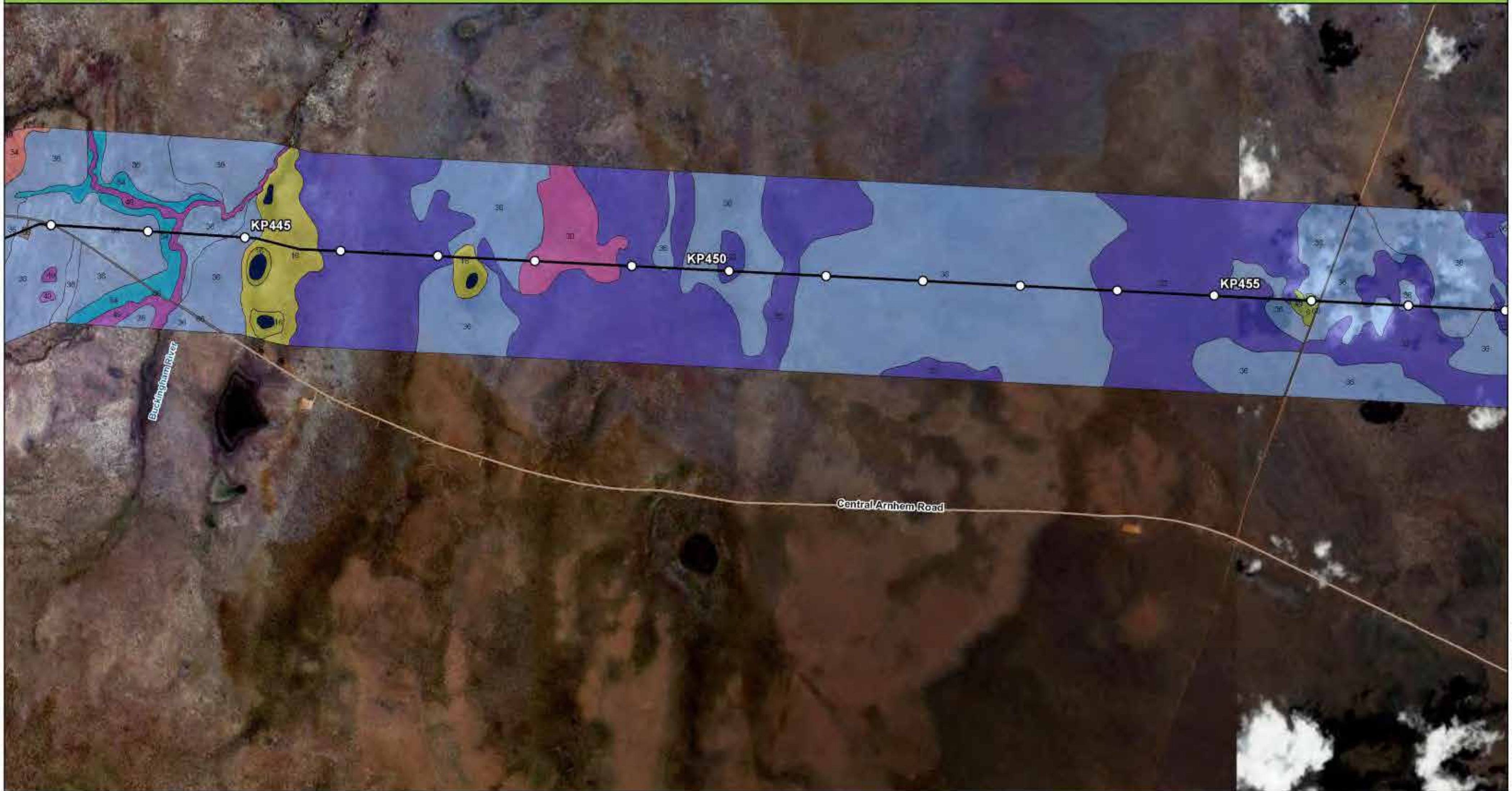
ELA Vegetation Mapping

Tile 38



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
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19 - Corymbia open forest
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34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
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38 - Heteropogon grassland
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40 - Lophostemon closed forest
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44 - Melaleuca closed forest
45 - Melaleuca forest
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49 - Melaleuca open forest
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53 - Melaleuca tall open woodland
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0 0.5 1 2
Kilometres

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ELA Vegetation Mapping

Tile 39

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
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- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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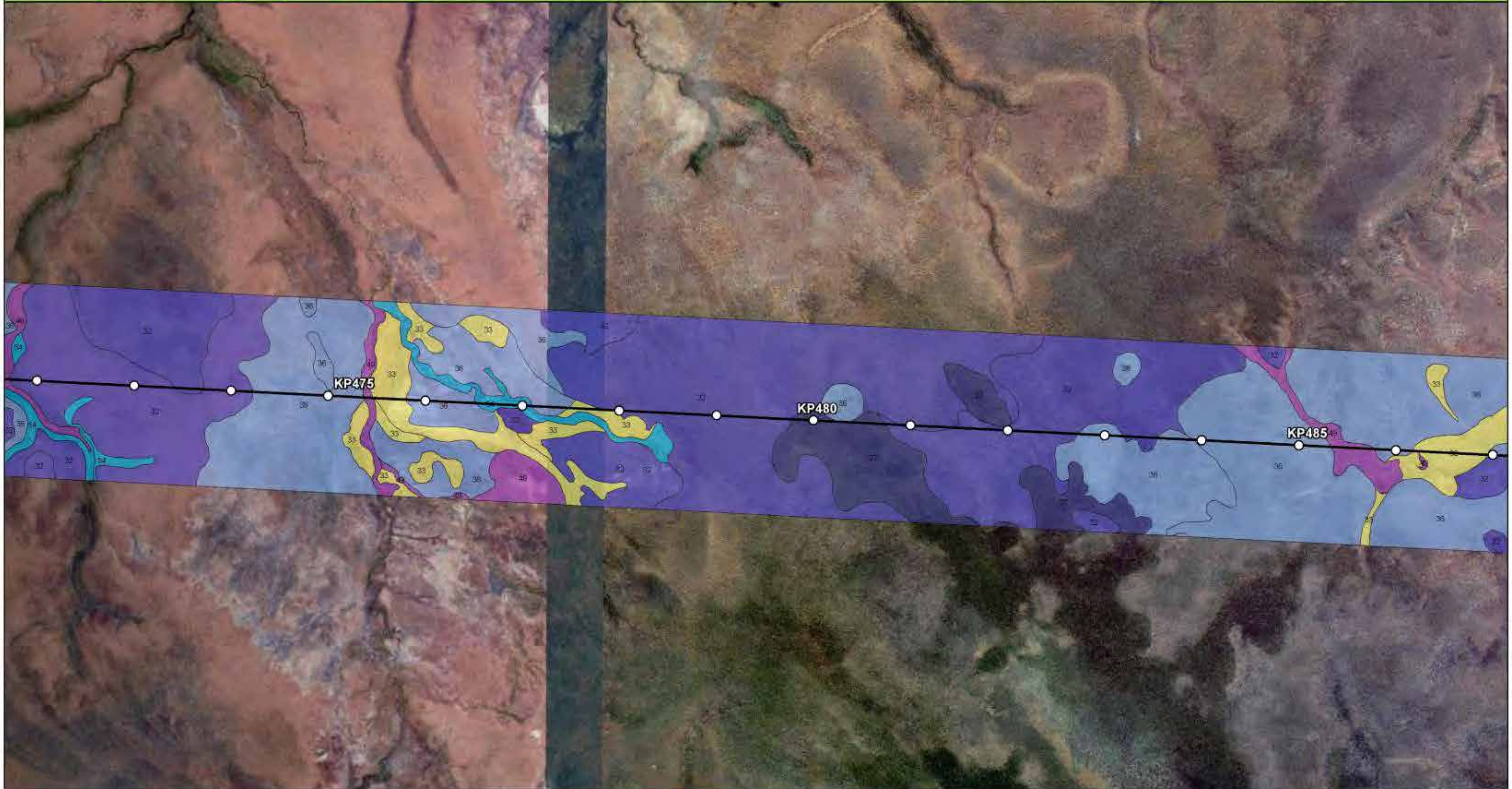
ELA Vegetation Mapping

Tile 40



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

0 0.5 1 2
Kilometres

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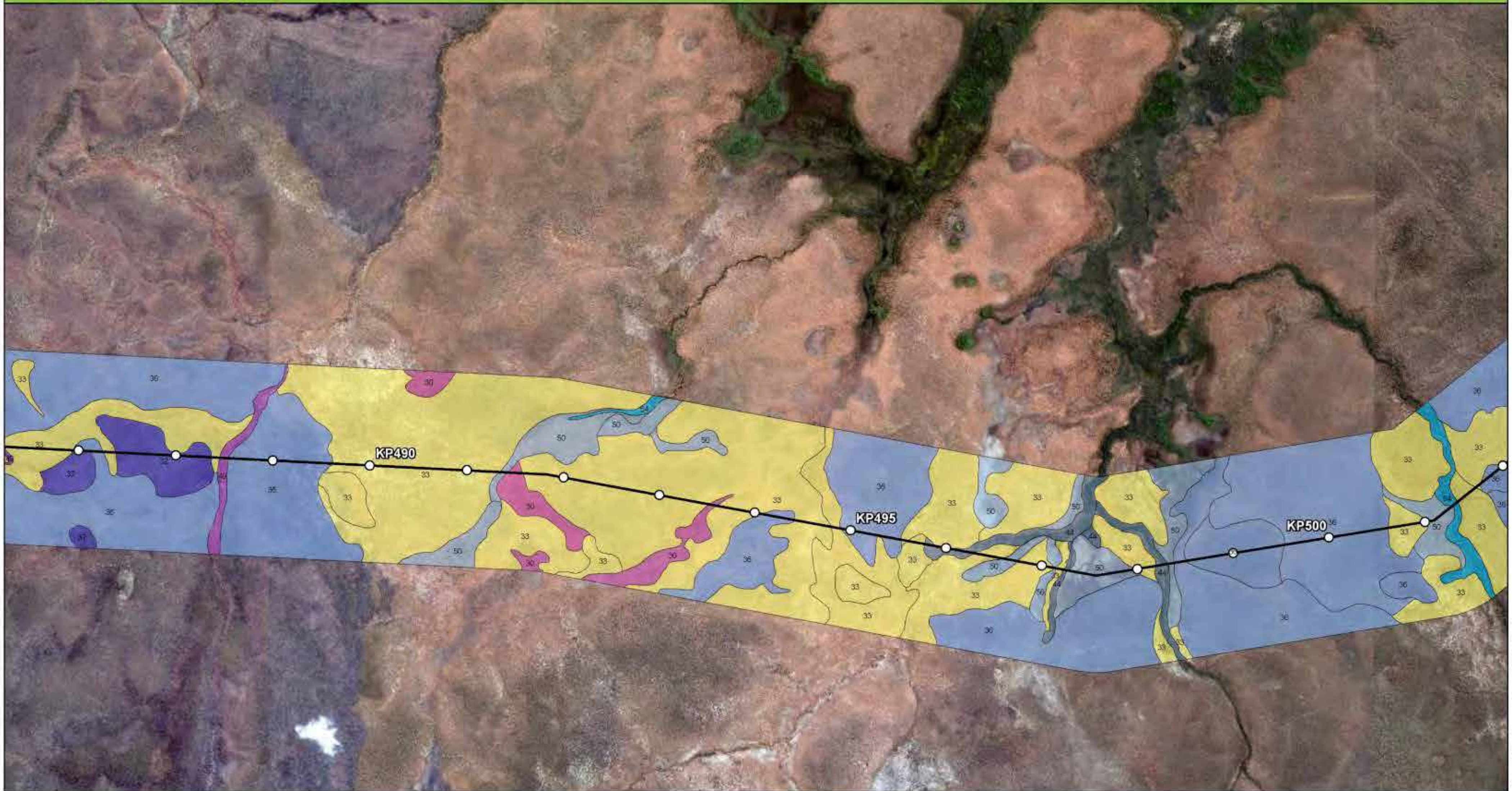
ELA Vegetation Mapping

Tile 41



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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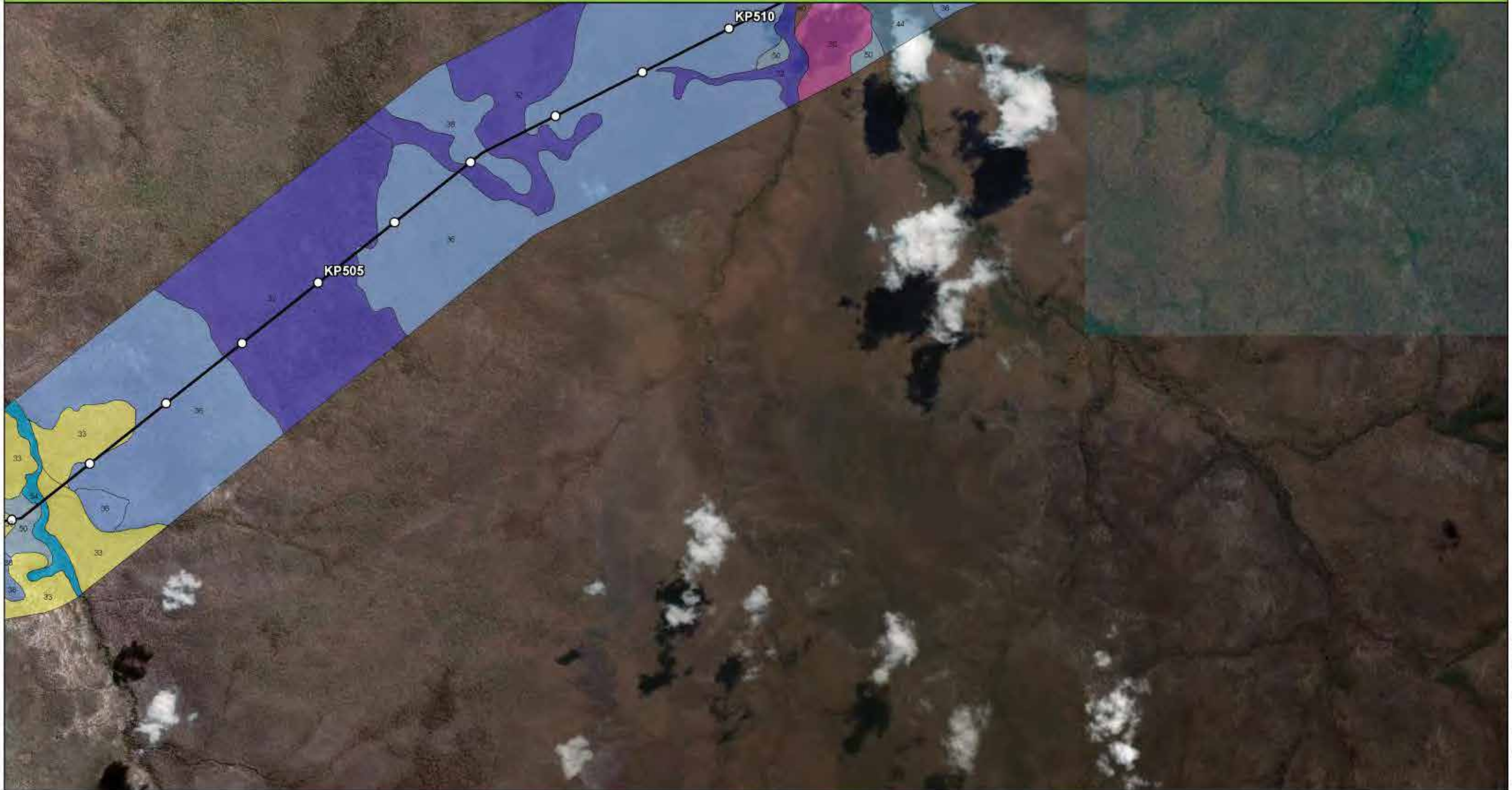
ELA Vegetation Mapping

Tile 42



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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ELA Vegetation Mapping

Tile 43

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
9 - Beach
10 - Callitris tall woodland
11 - Canarium (mixed) closed forest
12 - Casuarina closed forest
13 - Casuarina woodland
14 - Ceriops low closed forest
15 - Corymbia forest
16 - Corymbia low open forest
17 - Corymbia low open woodland
18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
52 - Melaleuca tall open forest
53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
56 - Mixed tussock grassland/sedgeland
57 - Petalostigma pubescens low woodland
58 - Platyzoma swamp
59 - Rhizophora closed forest
60 - Sandstone shrubland
61 - Sparse shrubland
62 - Tussock grassland
63 - Vine forest
64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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ELA Vegetation Mapping

Tile 44

Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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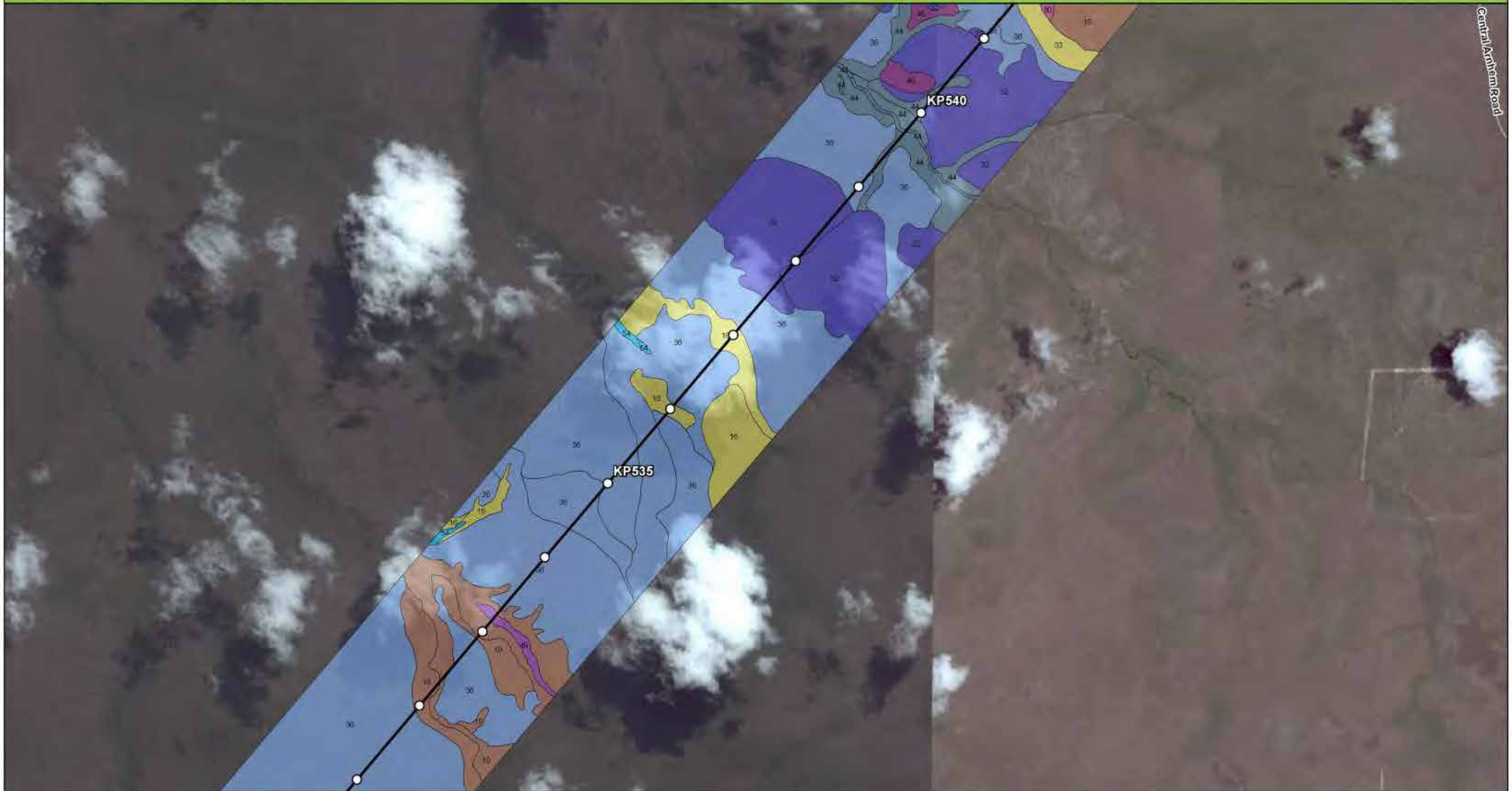
ELA Vegetation Mapping

Tile 45



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
- 14 - Ceriops low closed forest
- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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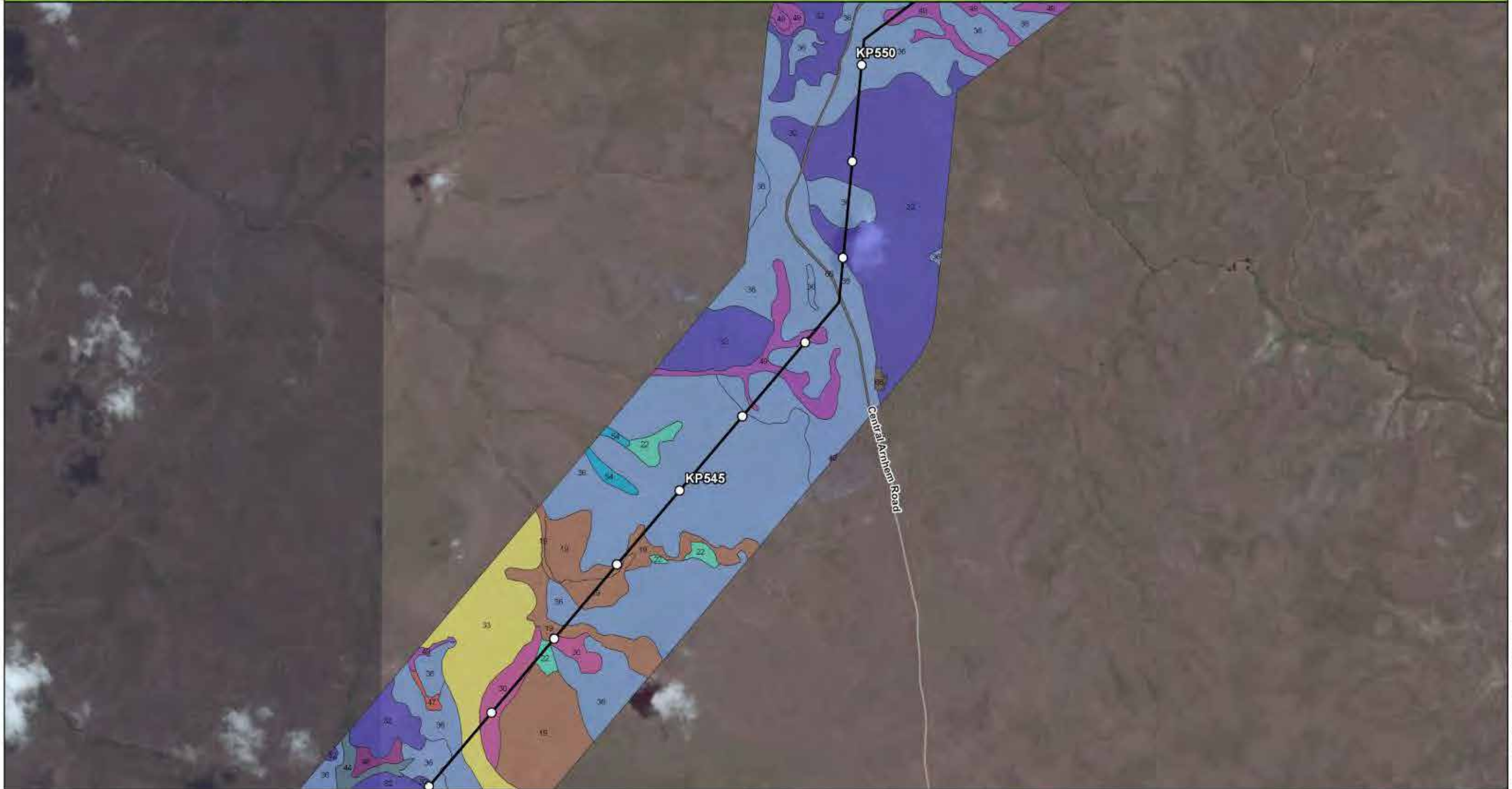
ELA Vegetation Mapping

Tile 46



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

- 1 - Acacia and Grevillea low woodland
- 2 - Acacia closed forest
- 3 - Acacia forest
- 4 - Acacia open forest
- 5 - Acacia open woodland
- 6 - Acacia woodland
- 7 - Aristida grassland
- 8 - Avicennia closed forest
- 9 - Beach
- 10 - Callitris tall woodland
- 11 - Canarium (mixed) closed forest
- 12 - Casuarina closed forest
- 13 - Casuarina woodland
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- 15 - Corymbia forest
- 16 - Corymbia low open forest
- 17 - Corymbia low open woodland
- 18 - Corymbia low woodland
- 19 - Corymbia open forest
- 20 - Corymbia open woodland
- 21 - Corymbia tall open woodland
- 22 - Corymbia woodland
- 23 - Eriachne grassland
- 24 - Erythrophleum low open woodland
- 25 - Erythrophleum variable open woodland
- 26 - Eucalyptus closed forest
- 27 - Eucalyptus forest
- 28 - Eucalyptus low forest
- 29 - Eucalyptus low open forest
- 30 - Eucalyptus low open woodland
- 31 - Eucalyptus low woodland
- 32 - Eucalyptus open forest
- 33 - Eucalyptus open woodland
- 34 - Eucalyptus tall open forest
- 35 - Eucalyptus tall woodland
- 36 - Eucalyptus woodland
- 37 - Halosarcia low sparse samphire shrubland
- 38 - Heteropogon grassland
- 39 - Heteropogon open grassland
- 40 - Lophostemon closed forest
- 41 - Lophostemon open forest
- 42 - Lophostemon open woodland
- 43 - Lophostemon woodland
- 44 - Melaleuca closed forest
- 45 - Melaleuca forest
- 46 - Melaleuca low open forest
- 47 - Melaleuca low open woodland
- 48 - Melaleuca low woodland
- 49 - Melaleuca open forest
- 50 - Melaleuca open woodland
- 51 - Melaleuca tall forest
- 52 - Melaleuca tall open forest
- 53 - Melaleuca tall open woodland
- 54 - Melaleuca woodland
- 55 - Mixed species open woodland
- 56 - Mixed tussock grassland/sedgeland
- 57 - Petalostigma pubescens low woodland
- 58 - Platyzoma swamp
- 59 - Rhizophora closed forest
- 60 - Sandstone shrubland
- 61 - Sparse shrubland
- 62 - Tussock grassland
- 63 - Vine forest
- 64 - Vine thicket
- 65 - Water
- 66 - Pastoral / Horticultural / Roads / Developed

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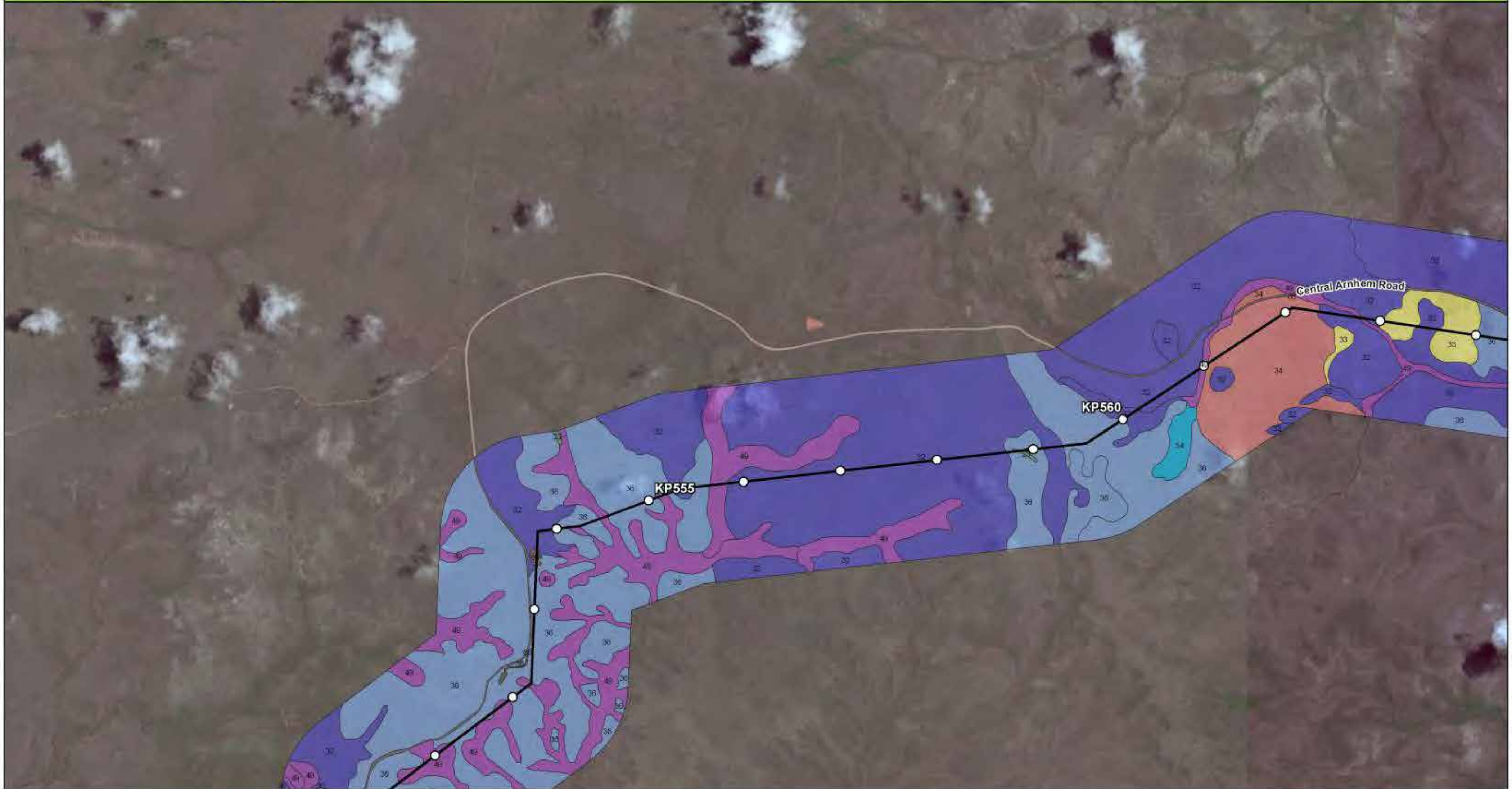
ELA Vegetation Mapping

Tile 47



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
2 - Acacia closed forest
3 - Acacia forest
4 - Acacia open forest
5 - Acacia open woodland
6 - Acacia woodland
7 - Aristida grassland
8 - Avicennia closed forest
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10 - Callitris tall woodland
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18 - Corymbia low woodland
19 - Corymbia open forest
20 - Corymbia open woodland
21 - Corymbia tall open woodland
22 - Corymbia woodland
23 - Eriachne grassland
24 - Erythrophleum low open woodland
25 - Erythrophleum variable open woodland
26 - Eucalyptus closed forest
27 - Eucalyptus forest
28 - Eucalyptus low forest
29 - Eucalyptus low open forest
30 - Eucalyptus low open woodland
31 - Eucalyptus low woodland
32 - Eucalyptus open forest
33 - Eucalyptus open woodland
34 - Eucalyptus tall open forest
35 - Eucalyptus tall woodland
36 - Eucalyptus woodland
37 - Halosarcia low sparse samphire shrubland
38 - Heteropogon grassland
39 - Heteropogon open grassland
40 - Lophostemon closed forest
41 - Lophostemon open forest
42 - Lophostemon open woodland
43 - Lophostemon woodland
44 - Melaleuca closed forest
45 - Melaleuca forest
46 - Melaleuca low open forest
47 - Melaleuca low open woodland
48 - Melaleuca low woodland
49 - Melaleuca open forest
50 - Melaleuca open woodland
51 - Melaleuca tall forest
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53 - Melaleuca tall open woodland
54 - Melaleuca woodland
55 - Mixed species open woodland
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65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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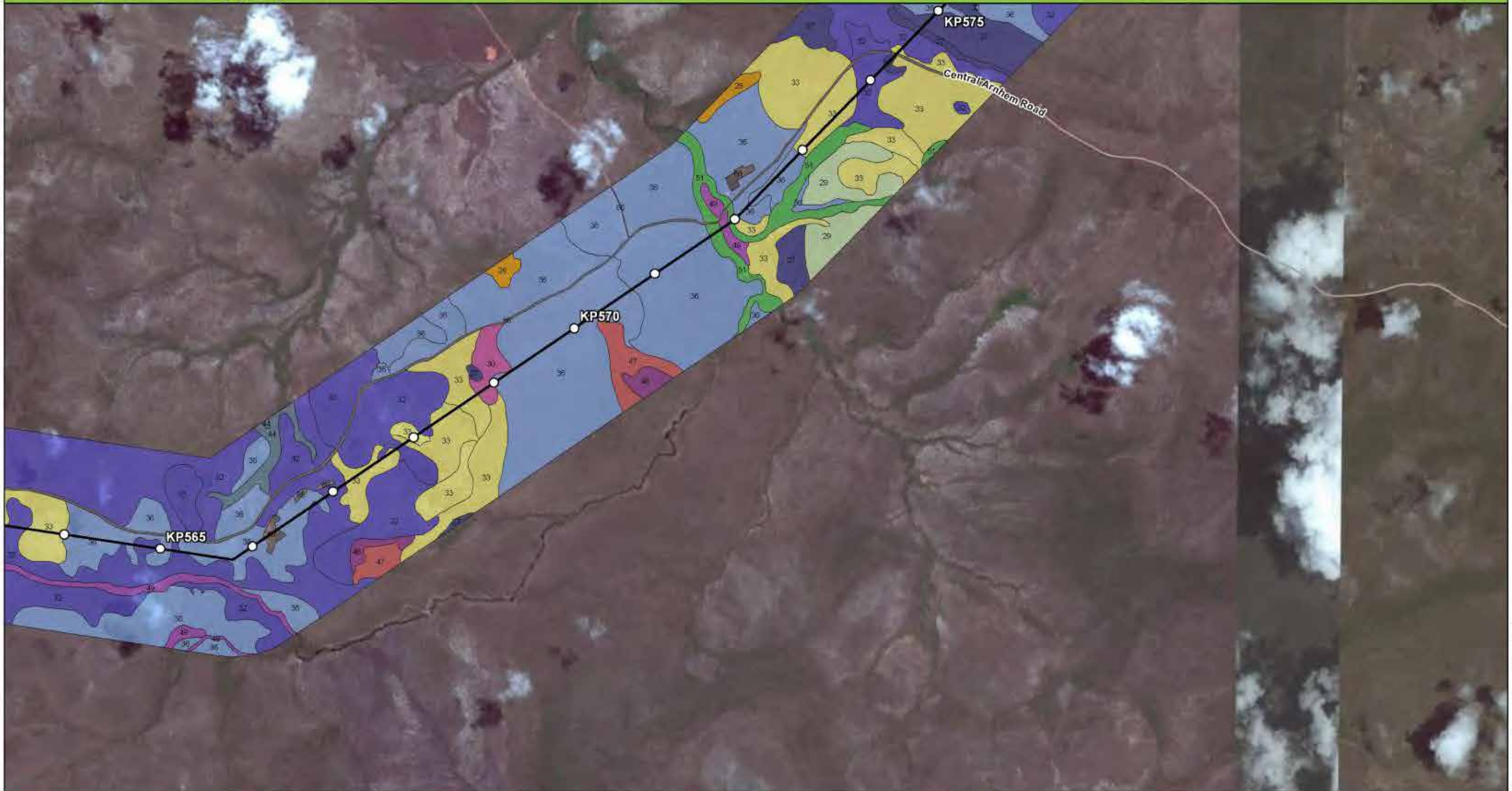
Status: Draft
Approved by: AZ
Prepared by: VH

Imagery: Microsoft Bing Maps and ESRI World Imagery

ELA Vegetation Mapping

Tile 48



Legend

- Proposed Katherine to Gove Gas Pipeline
- 1km Point Marker

ELA 2013 Vegetation Mapping

1 - Acacia and Grevillea low woodland
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62 - Tussock grassland
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64 - Vine thicket
65 - Water
66 - Pastoral / Horticultural / Roads / Developed

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Kilometres

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ELA Vegetation Mapping

Tile 49

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ELA Vegetation Mapping

Tile 50

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ELA Vegetation Mapping

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Appendix D

Native fauna handling management procedures

PACIFIC ALUMINIUM

Native fauna handling management procedures

KGGP

Prepared for
Pacific Aluminium

12 September 2013

DOCUMENT TRACKING

Item	Detail
Project Name	KGGP Native fauna handling management procedures
Project Number	1
Project Manager	Name: Andrew Buick Phone 08 8989 5603 16/56 Marina Boulevard, Cullen Bay, NT
Prepared by	Dr Sarah Smith
Reviewed by	Andrew Buick
Approved by	Andrew Buick
Status	FINAL
Version Number	1
Last saved on	12 September 2013

This report should be cited as 'Eco Logical Australia 2013. *KGGP Native fauna handling management procedures*. Prepared for Pacific Aluminium.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from John Jones.

Contents

1 Native fauna handling management procedures

1.1 Relevant legislation

- Territory Parks & Wildlife Conservation Act (Northern Territory)
- NT Animal Welfare Act (Northern Territory)
- Environmental Protection and Biodiversity Conservation Act (Commonwealth)

1.2 Personnel

1.2.1 Staff and visitors

During induction, all staff and visitors are to receive specific instructions for fauna encounters addressing:

- Fauna handler role and contact information
- Information on significant species likely to occur in Project area
- Considerations for driving
- Littering and waste management
- Feeding or approaching wildlife
- Non-native fauna

1.2.2 Fauna Handlers

Fauna handling teams will generally consist of a minimum of two staff with appropriate experience and permits.

Permits

All Fauna Handlers must hold:

- A “Permit to Interfere with Protected Wildlife” issued under the *Territory Parks and Wildlife Conservation Act*
- An approval letter from an approved animal ethics committee

Experience

The senior fauna handler in any team should have demonstrated experience:

- Inspecting trenches for fauna
- Identifying fauna
- Handling/collecting fauna (including venomous snakes)
- Assessing fauna condition (for release, medical treatment or euthanasia)
- Providing care for injured animals
- Euthanizing animals as required

1.3 Fauna observed within or adjacent to the ROW

Native animals encountered adjacent to ROW or in other construction areas will not be interfered with unless there is a threat to personnel safety in which case construction staff will arrange translocation by licensed handlers.

Fauna observed within the ROW by vehicle drivers and construction staff will be translocated out of the ROW by fauna handlers.

1.4 Trench and pipe management

1.4.1 Exposure of fauna to open trench

Landscape profile

As the 30 m right of way is cleared, material including vegetation, topsoil and excavated spoil are stockpiled parallel to the trench in heaps that may form a barrier to animals accessing the open trench.

Length of open trench

Each team of two fauna handlers can manage 25 – 30 km of trench. The length of open trench would be kept to the minimum necessary to allow for the pipe to be efficiently installed. Under good trenching conditions, the length of open trench is likely to be 40 km while in more difficult trenching conditions, this is likely to extend to approximately 60 km. The length of open trench will not exceed lengths capable of being practically inspected and cleared by the available fauna teams at any time.

Duration of open trenches

The trench will be opened and closed as quickly as practical.

1.4.2 Escape and removal of fauna from trench

Ramps

Trench plugs and fauna exit ramps will be provided at both ends of trenches at intervals not exceeding 1 km. Ramps allow larger, more mobile fauna to escape trenches.

Shelters

Shelters will be provided at 250 m spacing along all open sections of trench. Various shelter types and sizes are available; humid shelters comprising funnel traps with damp sawdust filled hessian sacks covering may be most useful for protecting and collecting small reptiles and mammals during the dry season construction period. PVC pipes either shaded, or covered with damp sawdust filled hessian sacks will provide retreats for larger reptiles or mammals. A combination of shelters will be provided to allow smaller fauna to avoid predation by larger animals.

Removal of water

Subject to site specific assessment, water will be removed from areas at the base of the trench in circumstances where it is considered that the pooled water may significantly attract wildlife into the trench

1.4.3 Fauna entrapment within pipes

Pipe inspection

Pipes are to be inspected prior to welding and lowering-in to ensure no fauna are present. Fauna are to be removed by fauna handlers or encouraged to leave of their own accord.

Pipe caps

Any open pipeline sections will be capped at end of shifts to prevent fauna entry.

1.4.4 Trench inspections

Daily schedule

Daily inspections of the open trench by trained fauna handling teams will be conducted within four hours of dawn, and will precede commencement of construction works. Inspections will comprise inspection of all shelters and of the trench base between shelters. Opportunistic observations may be made by other personnel while working around the trench, but only fauna handlers are to approach or handle fauna.

Daily trench monitoring of any open sections will continue throughout any breaks in construction.

Activity based

In additional to daily trench inspections, activity based inspection of particular trench sections will be conducted prior to lowering in of pipes or backfilling.

Any other excavation or pit (for hydrotest water or any other purpose) that has the potential to trap fauna must be checked daily.

1.5 Equipment

Each fauna handling team will have access to the following:

- 4 wheel drive utility vehicle
- UHF or VHF radio to allow communication with construction team
- Long-handled dip nets and hooks
- Snake handing equipment
- GPS, digital camera, datasheets
- Comprehensive selection of field guides
- Temporary holding/transporting containers suitable for a variety of vertebrate fauna (boxes, cages, cloth bags, plastic bags)
- Secure, labelled, holding/transport containers for venomous snakes
- Sufficient water for dehydrated animals
- Basic veterinary supplies including di-vetlac milk replacer and sodium pentobarbital for euthanasia
- Specimen fixing supplies – formalin, alcohol etc.

1.6 Entry to trench

Personnel entrance in the trench is prohibited. In the case entrance is required, ramps or bell holes (safe excavation where people can work) will be constructed and the trench inspected by qualified safety representatives before personnel are authorised into the trench or excavation.

1.7 Fauna removal protocol

Fauna is only to be removed from the trench or surrounds by the fauna handling teams. Large animals are to be herded to the nearest exit ramp. Shelters will be checked from the top of the trench (to avoid exposing staff to the confined space within the trench). Small animals within funnel traps will be retrieved by means of a rope attached to the trap. Other small fauna will be retrieved using long handled nets and hooks as required.

The condition of collected fauna will be assessed and they will be released, rehabilitated or euthanized as appropriate. Fauna fit for release will be relocated to suitable habitat as near as practicable to the site of capture. Fauna removed from the trench should generally be realised immediately. Exceptions may occur for fauna that need care (e.g., rehydration), or those that cannot be confidently identified.

1.8 Data collection

1.8.1 Reporting

As required under the NT “Permit to Interfere with Protected Wildlife”, all fauna observed or removed from the trench will be identified to species, and their locality will be logged. Data will be provided to the department of Land Resource Management for inclusion in the NT Fauna Atlas.

Data regarding the time of collection, and the type of shelter being used by will also be collected to optimise fauna collection strategies throughout the project.

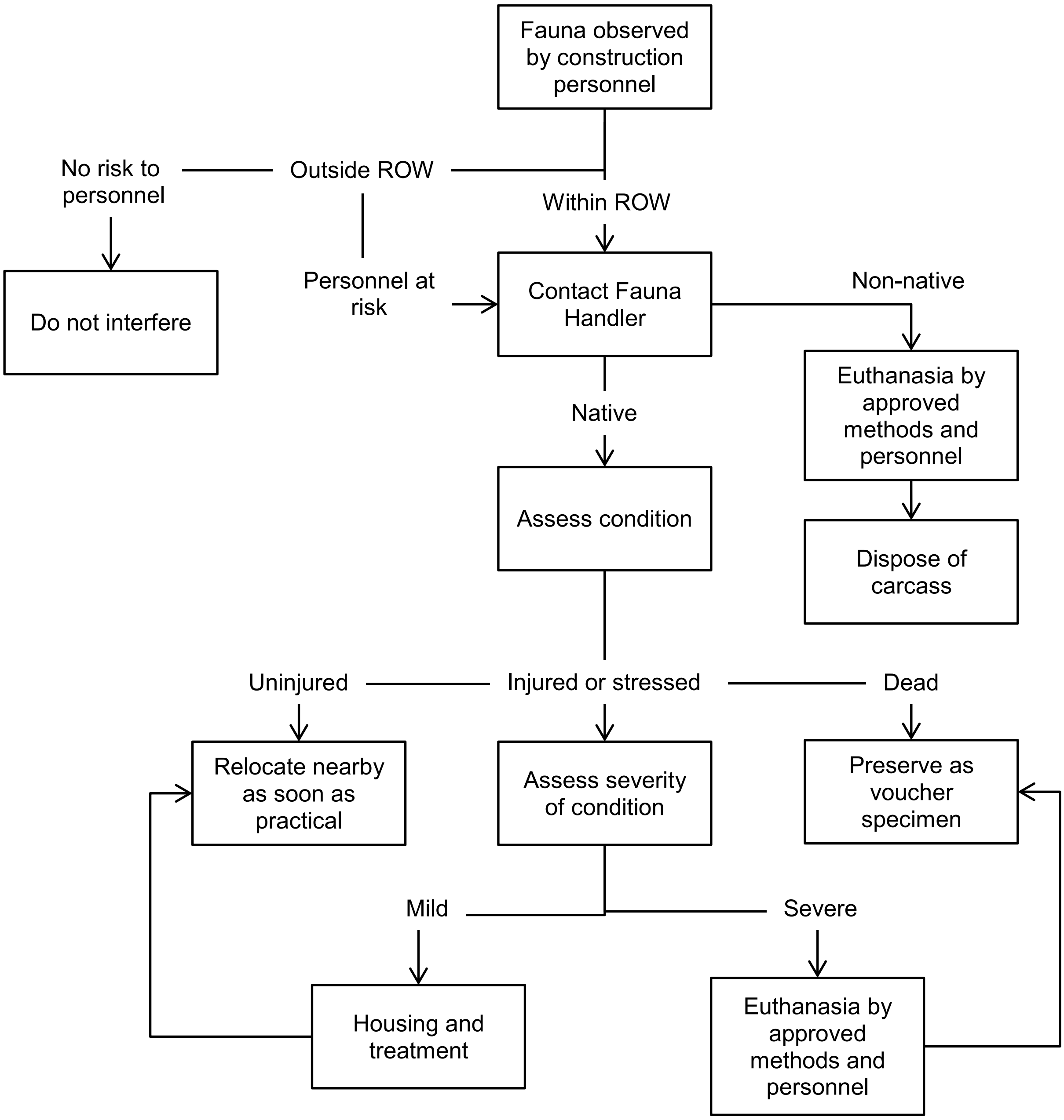
1.8.2 Voucher specimens

Any fauna found dead or euthanized will be appropriately preserved and lodged, with accompanying data in the collection of the Museum and Art Gallery of the Northern Territory.

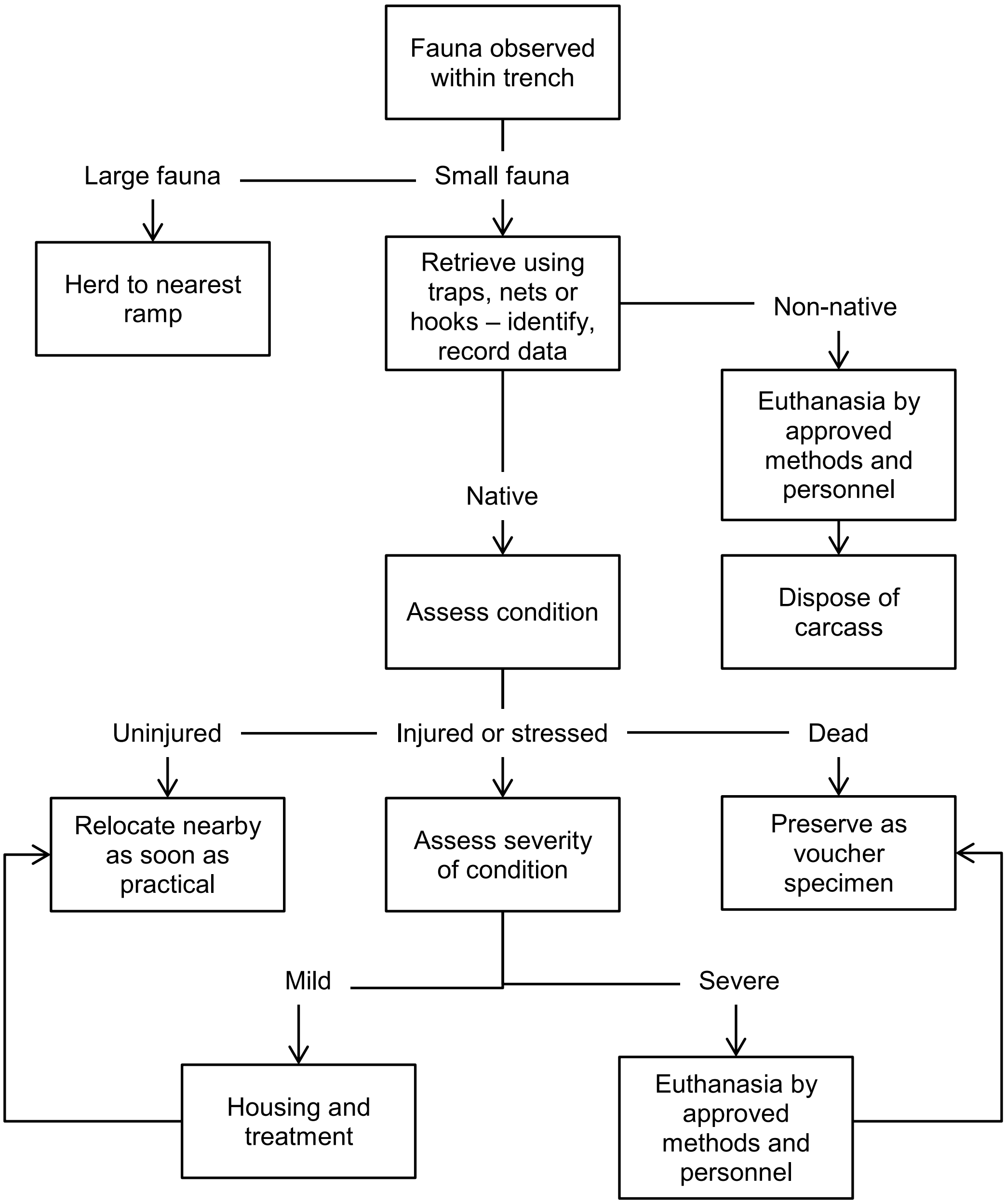
1.9 Non-native fauna

Subject to consideration of landholder views, non-native fauna removed from trenches will be euthanized using species-appropriate methods (as described in the animal care and ethics committee approval letter). Occurrence of non-native fauna will be included in data recording, but voucher specimens will not be collected.

1.10 Fauna handling procedure – observations by construction staff



1.11 Fauna handling procedure – trench and excavation inspection



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F 02 6372 9230

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PACIFIC ALUMINIUM

Appendix E

Draft Environmental Impact Statement and Social Impact Assessment Consultations

PACIFIC ALUMINIUM

Draft Environmental Impact Statement consultations (incorporating Social Impact Assessment consultations) 2013

DATE	MEETING TYPE	STAKEHOLDER TYPE	STAKEHOLDER	MEETING SUMMARY
03/09/13	EIS public consultation forum	Businesses/businesses associations	Gove Operations – employees and contractors	Information about the KGGP project and awareness about the project
02/09/13	Telephone	Local government	Katherine Town Council	Further discussions about the use and limitations of Tindal airport.
29/08/13	Meeting	Businesses / business associations	Aboriginal Investment Group	Discussed potential business opportunities – tender packages and employment of local Traditional Owners.
22/8/13	Meeting	Pastoralist	Mainoru property owner	Discussed update on project and timing
21/8/13	Meeting	Pastoralist	Sunday Creek property owner	Discussed update on project and timing
9 - 12/08/13	Community event	Various	Garma Festival at Galuka Interested community members/Traditional Owners Government and non-Government agency representatives	Information stand Ito inform stakeholders about the draft EIS, provide awareness about the project in verbal and visual format.
09/08/13	EIS public consultation forum	Businesses/businesses associations	Gove Operations – employees and contractors	Information about the KGGP project and awareness about the project
1 - 23/08/13	Field work	Communities	Traditional Owners and broader family group meetings – Gapuwiyak/Mitchell Ranges	Discuss and inspect locations in the field - construction activities, potential environmental and social impacts of KGGP project and mitigation strategies with Traditional Owners.
17/0713	Briefing	Northern Territory Government	Liquor Licensing	Information about the KGGP project and discuss potential social impacts in particular liquor conditions in the Northern Territory.
17/07/13	Meeting	Non-government organisation / association	Gumatj Aboriginal Corporation Chief Executive Officer and Traditional Owners including board members	Discussed potential social impacts of KGGP project and mitigations strategies, and project updates.
17/07/13	Meeting	Northern Territory Government	NT Police, Fire and Emergency Services - Nhulunbuy police	Discussed update on project and potential social impacts of the project.
17/07/13	Meeting	Non-government organisation / association	Miwatj Health Aboriginal Corporation	Provide information about the project, record concerns and issues raised by the stakeholder in relation to any potential impacts of a social nature to be included in the project SIMP.
17/07/13	Meeting	Northern Territory Government	Regional Economic Development Committee including government and non-government representatives	Provide information about the project, record concerns and issues raised by the stakeholder in relation to any potential impacts of a social and economic nature to be included in the project SIMP.
9/7/13	Meeting	Pastoralists	Conways Property Owners	Provide information about the project
8/07/13	Meeting	Non-government organisation / association	Amateur Fishermen's Association NT (AFANT)	Discussed Draft EIS submission and potential environment and social impact concerns.
3 - 12/07/13	Field work	Communities	Traditional Owners and broader family group meetings - Mitchell Ranges	Discussed potential social impacts of KGGP project and mitigation strategies with Traditional Owners, Pastoral Property Owners and supporting services.
3/07/13	Meeting	Businesses / business association	Aboriginal Investment Group including a Senior Traditional Owner	Discussed update on project and potential employment opportunities and commitments in the EIS.
31/06/13	EIS public information stand	Communities	Interested community members within Nhulunbuy community and surrounding areas	Information stand at Nhulunbuy Woolworths. Draft EIS introduction and awareness about the project.
30/06/13	EIS public information stand	Communities	Interested community members within Nhulunbuy community and surrounding areas	Information stand at Nhulunbuy Woolworths. Draft EIS introduction and awareness about the project.
25/06/13	Briefing	Northern Territory Government	Department of Health Including representation for Katherine/Gove and remote clinics	Discussed potential social impacts of KGGP project and the involvement of a health management plan.
24/06 – 5/07/13	Field work	Communities	Interested community members within impacted communities along pipeline corridor from Katherine to Bulman	Discuss and inspect locations in the field - construction activities, potential environmental and social impacts of KGGP project and mitigation strategies with Traditional Owners and Pastoral Owners.
23/06/13	EIS public consultation	Commonwealth Government	Department of SEWPaC	Discussed update on project and Draft EIS content.
21/06/13	Briefing	Northern Territory Government	Department of Land Resource Management, Palmerston	Provided an overview of the project and recorded concerns within the Draft EIS and potential social impacts of project.

DATE	MEETING TYPE	STAKEHOLDER TYPE	STAKEHOLDER	MEETING SUMMARY
20/06/13	EIS public consultation	Local government	Roper Gulf Shire Council - Manyallaluk (Eva Valley)	Information about the KGGP project and discuss potential social impacts.
20/06/13	EIS public consultation	Communities	Traditional Owner - Elder for Jawoyn to Bagala	Information about the KGGP project and discuss potential social impacts.
19/06/13	EIS public information stand	Communities	Interested community members within Bulman community and surrounding areas including Weemol	Information stand at Bulman community store. Information about the KGGP project and awareness about the project.
19/06/13	EIS public consultation	Northern Territory Government	NT Police, Fire and Emergency Services - Katherine / Bulman police	Draft EIS introduction and awareness about project. Potential social impacts discussed include condition of CAR, safety of the community crossing the road and driving on it.
19/06/13	EIS public consultation	Local government	Roper Gulf Shire Council - Bulman	Brief project update. Potential social impacts discussed include communication channels in Bulman community and traffic / road safety.
19/06/13	EIS public consultation SIA information	Non-government organisation / association	Sunrise Health Service Aboriginal Corporation	Information about the project and potential social impacts. Potential social impacts discussed include utilisation of community health services.
18/06/13	EIS public information stand	Communities	Interested community members within Beswick community and surrounding areas	Information stand at Beswick community store. Information about the KGGP project and awareness about the project. Potential social impacts discussed include community issues such as substance abuse (petrol sniffing) and traffic safety concerns.
18/06/13	EIS public information stand	Communities	Interested community members within the Mainoru area	Information stand at Mainoru community store. Information about the KGGP project and awareness about the project.
18/06/13	EIS public consultation	Communities	Mainoru Store Managers	Information about the KGGP project and awareness about the project. Potential social impacts discussed include condition of Central Arnhem Road, safety of motorists, and impact / benefit for local business.
18/06/13	EIS public consultation	Local government	Roper Gulf Shire Council	Information about the KGGP project and awareness about the project. Potential social impacts discussed include safety of pedestrians, the management and control of the pipeline workers, the management of traffic movements and the damage to local roads and infrastructure.
17/06/13	EIS public consultation	Communities	Interested community members within Barunga community and surrounding areas	Information stand at Barunga Council office. Information about the KGGP project and awareness about the project.
17/06/13	Meeting	Businesses / business associations	Katherine community, various businesses	Discussed update on progress of project and potential procurement opportunities.
13/06/13	Meeting	Commonwealth Government	Department of Infrastructure and Transport Department of SEWPaC Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education Department of Resources, Energy and Tourism Department of the Prime Minister and Cabinet Department of Finance and Deregulation Treasury	KGGP Project and Draft EIS brief.
13/06/13	EIS public information stand	Communities	Interested members of the Nhulunbuy and surrounding communities	Information stand at Nhulunbuy Woolworths. Information about the KGGP project and awareness about the project.
13/06/13	Meeting	Northern Territory Government	NT Police, Fire and Emergency Services - Nhulunbuy police	Information about the KGGP project and discuss potential social impacts.
12/06/13	EIS public information stand	Communities	Interested community members within Nhulunbuy community and surrounding areas	Information stand at Nhulunbuy Woolworths. Information about the KGGP project and awareness about the project.
8 - 9/06/13	Community event	Communities	Interested attendees at Barunga Cultural Festival	Information stand at Barunga Festival. Information about the KGGP project and awareness about the project.
5/06/13	EIS public information stand	Communities	Interested community members within Katherine community and surrounding areas	Information stand at Katherine Woolworths. Information about the KGGP project and awareness about the project.
5/06/13	Meeting	Pastoralist	Goondooloo property owners	Discussed the Draft EIS including environmental and social impacts

DATE	MEETING TYPE	STAKEHOLDER TYPE	STAKEHOLDER	MEETING SUMMARY
5/06/13	Meeting	Pastoralist	Moroak property owners	Discussed the Draft EIS including environmental and social impacts
4/06/13	EIS public information stand	Communities	Interested community members within Katherine community and surrounding areas	Information stand at Katherine Woolworths. Information about the KGGP project and awareness about the project.
4/06/13	Briefing	Businesses / business association	Various businesses who attended the KRME, including the Chamber of Commerce Katherine	Presentation at the Katherine Regional Mining & Exploration Forum.
4/6/2013	Meeting	Businesses / business association	Various businesses in Katherine and surrounding area	Viewed local business facilities and discussed capability to support KGGP Project with various business owners.
3/06/13	Briefing	Northern Territory Government	NT Environmental Protection Agency including other Government agency representatives	Information about the Draft EIS, KGGP project update and awareness about the project.
31/05/13	EIS public information stand	Communities	Interested community members within Yirrkala including Traditional Owners	Information stand at IGA store. Information about the KGGP project and awareness about the project.
27/05/13	Meeting	Businesses / business association	Industry Capability Network (ICN) Northern Territory	Meet with the project team about how to maximise local businesses for the KGGP project.
24/05/13	EIS public information stand	Communities	Interested community members within Katherine community and surrounding areas	Information stand at Woolworths store. Information about the KGGP project and awareness about the project.
24/05/13	EIS public consultation forum	Communities	Interested members of the Katherine and surrounding communities	Public consultation session at Katherine Town council. Information about the KGGP project and awareness about the project.
24/05/13	Meeting	Pastoralist	Mainoru property owners	Discussed the Draft EIS including environmental and social impacts
24/05/13	Meeting	Pastoralist	Sunday Creek property owners	Discussed the Draft EIS including environmental and social impacts
23/05/13	EIS public information stand	Communities	Interested community members within Katherine community and surrounding areas	Information stand at Woolworths shopping centre Information about the KGGP project and awareness about the project.
23/05/13	EIS public consultation forum	Communities	Interested community members within Katherine community and surrounding areas	Public consultation session at Katherine Town council. Information about the KGGP project and awareness about the project.
22/05/13	Meeting	Northern Territory Government	Aboriginal Areas Protection Authority	Information about the KGGP project update and commitments in Draft EIS.
21/05/13	EIS public information stand	Communities	Interested community members within Nhulunbuy community and surrounding areas	Information stand at Woolworths store. Information about the KGGP project and awareness about the project.
21/05/13	EIS public consultation forum	Communities	Interested community members within Nhulunbuy community and surrounding areas	Public consultation session at Town Hall. Information about the KGGP project and awareness about the project.
20/05/13	EIS public information stand	Communities	Interested community members within Nhulunbuy community and surrounding areas	Information stand at Woolworths store. Information about the KGGP project and awareness about the project.
20/05/13	EIS public consultation forum	Communities	Interested community members within Nhulunbuy community and surrounding areas	Public consultation session at Walkabout Hotel. Information about the KGGP project and awareness about the project.
20/05/13	Meeting	Northern Territory Government	Local Member for Nhulunbuy	Update on KGGP Project and further discussion around potential social impacts and mitigation strategies.
20/05/13	Meeting	Non-government organisation / association	Yirralka Rangers including Traditional Owners and employees	Information about the KGGP project and discuss potential social impact and opportunities for project involvement.
20/05/13	Meeting	Non-government organisation / association	Dhimurru Aboriginal Rangers including Traditional Owners employees	Information about the KGGP project and discuss potential social impacts and opportunities for project involvement.
19/05/13	Meeting	Non-government organisation / association	NLC staff members	Information about the KGGP project and discuss potential social impacts.
20/05/13	EIS public consultation forum	Businesses/businesses associations	Gove Operations – employees and contractors	Information about the KGGP project and awareness about the project
15/05/13	Meeting	Communities	NLC – Traditional Owner, Aboriginal	Information about the Draft EIS, KGGP project activities and potential social

DATE	MEETING TYPE	STAKEHOLDER TYPE	STAKEHOLDER	MEETING SUMMARY
			Organisations and community members	impacts
10/05/13	Briefing	Media	Local NT Media	Briefing provided to media on KGGP project, EIS content - opportunity for media interviews and questions about the project.
7/05/13	Meeting	Communities	Traditional Owners - outstations and Northeast Arnhem Land including Nhulunbuy	Information about the KGGP project and discuss potential social impacts.
7 – 14/05/13	Field work	Communities	Traditional Owners – Mitchell Ranges region	Survey and record environmental information for KGGP Draft EIS. Discussions with Traditional Owners about environmental monitoring.
30/04/13	Meeting	Non-government organisation / association	Minerals Council Australia	Draft EIS including economic and social impact discussion and KGGP project briefing.
29-30/04/13	Meeting	Communities	Traditional Owners – Gapuwiyak community including outstations of Gan Gan, Yiralpa and Dhalinwbuy	Information about the Draft EIS and KGGP project including potential social impacts.
28/04 – 2/05/13	Field work	Communities	Traditional Owners - Beswick region	Survey and record environmental information for KGGP Draft EIS. Discussions with Traditional Owners about environmental monitoring
29/4/13	Telephone	Pastoralist	Conways property owners	Discussion about KGGP project – draft EIS
26/04/13	Teleconference	Businesses / business associations	Industry Capability Network	Introduction to the services of ICN NT (local procurement and employment strategy).
22/04/13	Meeting	Pastoralist	Property owner – Mountain Valley	Discussion about KGGP project – draft EIS
22/04/13	Meeting	Non-government organisation / association	Gumatj Aboriginal Corporation	Information about the KGGP project and discuss potential economic and social impacts.
19/04/13	Telephone	Pastoralist	Mainoru property owners	Discuss the Draft EIS and project update and potential field work..
17/04/13	Meeting	Northern Territory Government	Department of Business	KGGP project introduction and discussions about local procurement and involvement of local businesses.
12/04/13	Meeting	Non-government organisation / association	Rirratjingu Aboriginal Corporation Including Traditional Owners, Board Members	Information about the KGGP project and discuss potential social impacts.
12/04/13	Meeting	Communities	Traditional Owners - Ngukurr	Information about the KGGP project and discuss potential social impacts.
11/04/13	Meeting	Communities	Traditional Owners including the Mimal Ranger groups – Bulman	Information about the KGGP project and discuss potential social impacts.
10/04/13	Meeting	Communities	Traditional Owners from various impacted community groups - Katherine	Information about the KGGP project and discuss potential social impacts.
9/04/13	Meeting	Communities	Barunga Community – Traditional Owners	Information about the KGGP project and discuss potential social impacts.
4-5/04/13	Meeting	Communities	Traditional Owners from various impacted community groups - Nhulunbuy and outstations within North East Arnhem Land	Information about the KGGP project and discuss potential social impacts.
3/04/13	Meeting	Businesses / business associations	Aboriginal Investment Group	Discussion KGGP opportunities for Aboriginal Investment Group - Joint Venture.
26/03/13	Briefing	Northern Territory Government	Katherine Hospital	Information about the KGGP project and discussed potential support required from stakeholder.
25/03/13	Briefing	Northern Territory Government	Nhulunbuy Hospital	Information about the KGGP project and discussed potential support required from stakeholder.
22/03/13	Meeting	Pastoralist	King River Station property owner	Discuss the Draft EIS,
21/03/13	Briefing	Non-government organisation / association	Dhimurru Aboriginal Corporation	Information about the KGGP project and discussed potential social impacts and opportunities.
19/03/13	Meeting	Northern Territory Government	Department of Transport	Discussed which access tracks may have issues with culturally restricted areas on Department of Transport records to be captured in the construction plan and adhered to.

DATE	MEETING TYPE	STAKEHOLDER TYPE	STAKEHOLDER	MEETING SUMMARY
15/03/13	Meeting	Commonwealth Government	Various Government Agencies	Gas to Gove discussion and brief on KGGP Project.
15/03/13	Briefing	Local government	Roper Gulf Shire Council	Information about the KGGP project and discussed potential social impacts.
14/03/13	Briefing	Local government	Katherine Town Council	Information about the KGGP project and discussed potential social impacts.
13/03/13	Briefing	Commonwealth Government	Department of Defence	Information about the KGGP project and discussed potential social impacts.
12/03/13	Briefing	Northern Territory Government	Various agency representatives	Information about the KGGP project and discussed potential social impacts.
12/03/13	Briefing	Non-government organisation / association	Northern Land Council	Information about the KGGP project and discussed potential social impacts.
11/03/13	Briefing	Northern Territory Government	Department of Health	Information about the KGGP project and discussed potential social impacts and support project may require.
11/03/13	Briefing	Local government	Nhulunbuy Corporation Limited	Information about the KGGP project and discussed potential social impacts.
8/03/13	Briefing	Businesses / business associations	Aboriginal Investment Group	Gas to Gove pipeline - introduction meeting.
8/03/13	Teleconference	Local government	East Arnhem Shire Council	Information about the KGGP project and discussed potential social impacts.
7/03/13	Briefing	Northern Territory Government	Department of Business, Liquor Licensing	Information about the KGGP project and discuss potential social impacts in particular liquor conditions in the Northern Territory.
7/03/13	Teleconference	Local government	Katherine Town Council	Information about the KGGP project and discussed potential social impacts.
7/03/13	Briefing	Non-government organisation / association	Aboriginal Areas Protection Authority	Information about the KGGP project and discuss potential social impacts including the need to identity and apply for sacred site certificates.
6/03/13	Briefing	Non-government organisation / association	Environment Centre Northern Territory	Information about the KGGP project and discuss potential environment and social impacts.
6/03/13	Briefing	Local government	CEOs and staff of following shires / Councils Katherine Roper Gulf East Arnhem Nhulunbuy Corporation	Local Government Association NT meeting held in Darwin Brief overview of the project, expected timeframes and potential social impacts.
24/01/13	Meeting	Northern Territory Government	Department of Transport	Discussed details developed since the first meeting and covered bridges and other crossings as well as weather access issues to Gove / Beswick / Goyder etc.
18/01/13	Meeting	Northern Territory Government	Department of Transport	Discussed considerations for the Central Arnhem Road at the Katherine end.

*Meetings with the NLC have not been detailed in this register as they occur frequently (weekly/fortnightly)
*Majority of community meetings have included NLC representations


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