Project Order

Proforma 2020

1. Short Project Title

Understanding and managing impacts to biodiversity from roads and pipelines in the Beetaloo

Long Project Title	Developing scientific understanding and management approaches to reduce impacts on biodiversity from roads and pipelines in the Beetaloo Sub-basin
GISERA Project Number	B.7
Proposed Start Date	01/01/2021
Proposed End Date	30/06/2022
Project Leader	Chris Pavey

2. GISERA Region

- ☐ Queensland
- ☐ New South Wales
- ☒ **Northern Territory**
- ☐ South Australia
- ☐ Western Australia
- ☐ Victoria

3. GISERA Research Program

- ☐ Water Research
- ☐ GHG Research
- ☐ Social & Economic Research
- ☒ **Biodiversity Research**
- ☐ Agricultural Land Management Research
- ☐ Health Research

4. Project Summary

Objective

The project seeks to understand how the extension of linear transport infrastructure (mainly roads and pipelines) in the Beetaloo Sub-basin during the development of an onshore gas industry will impact biodiversity. It will then use this new scientific information to identify areas that are most threatened from infrastructure development and provide information to support management approaches and decision making across industry and government to reduce the risk to biodiversity while facilitating development. This information will be useful to the community to help understand the biodiversity values that may be threatened by development and to provide options to regulators on how impacts can be minimised.

The project partially addresses **Recommendation 8.7, 8.9, 8.10 and 8.11** of the *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory* (2018).

Description

The research will have four modules. Modules one and two will be undertaken in the field in the Beetaloo Sub-basin (see Figure 1). The focal area in the Beetaloo Sub-basin will be heavily impacted by the extension of linear transport infrastructure therefore fieldwork will be maximally useful here. The region contains a wide range of vegetation communities including savanna woodlands, grassland and several sensitive vegetation communities (i.e. lancewood and bullwaddy woodland, open forest and thickets). Lancewood and bullwaddy assemblages support species of plants and animals that the study team has identified as being potentially at risk from development. The fieldwork will examine how the biodiversity of the Beetaloo is impacted by existing habitat fragmentation and the presence of barriers to movement and how these impacts are influenced by the presence of habitat linkages and connectivity. Module one will examine how key components of the region's biodiversity are influenced by the size and degree of spatial isolation of patches of habitat (referred to as 'patch mosaics') and by the amount of habitat that shares a boundary with open vegetation rather than being intact (referred to as 'edge effects'). Module two will assess how roads and pipelines influence the movements of and act as sources of reduced growth and mortality for biodiversity. An assessment of road mortality of animals and dust impacts on plants will be undertaken on roads that differ in width, traffic volumes and degree of disturbance. The aim will be to understand existing impacts in order to predict how impacts may increase with road widening, increased traffic volumes and an increase in extent of the road network.

Module three will combine the improved scientific understanding from modules one and two with mapping approaches to develop a connectivity map for the study area. The map will identify connectivity corridors and 'at risk' linkages. Module four will use the information from the mapping component and available scientific knowledge in the literature to develop appropriate measures of mitigating risk from the development of roads and pipelines for consideration by the regulator for possible use in gas field design and policy settings such as offsetting guidelines.

Need & Scope

There are risks that exist relating to the potential loss of terrestrial biodiversity, ecosystem function and landscape amenity if an onshore gas industry is developed in the Beetaloo Sub-basin. One major form of impact will be from the establishment/extension of linear transport infrastructure (in particular roads and pipelines) and from the subsequent use of roads by heavy-vehicle traffic. The scale of potential changes in road and pipeline infrastructure is summarised in KPMG (2019). The Final Report of the Inquiry into Hydraulic Fracturing in the Northern Territory (2018) (page 200) concluded that with no further mitigation the overall assessment of risk to biodiversity from road and pipeline corridors and fragmentation of habitat would be 'medium', and unacceptable.

Measures therefore need to be developed to mitigate these risks. Before these measures can be developed, more understanding is needed of the response of key components of the biodiversity of the Beetaloo to fragmentation of habitat and how roads and other linear transport infrastructure may function as a barrier to movement. As identified in the Final Report of the Inquiry into Hydraulic Fracturing these issues have not been investigated in the savannas of northern Australia. The biodiversity of the northern savannas is unique and the response of its key components to linear transport infrastructure may differ from that demonstrated in other regions of the world. However, CSIRO will use existing scientific information from studies undertaken in temperate and rainforest dominated regions of the tropics to develop our study design. The project will identify areas at risk and provide advice on appropriate measures of mitigating this risk. In carrying out this work the project will make an important contribution to global understanding of fragmentation effects and barriers to movement in tropical regions.

NT Hydraulic Fracturing Inquiry Recommendations

Given the absence of any information on the effects of fragmentation on the fauna and flora of the Beetaloo Sub-basin, this project proposes a program of work that involves gathering of scientific knowledge to apply to the design of the network of roads and pipelines. To this end, this project partially addresses the following recommendations of the NT Hydraulic Fracturing Inquiry:

Recommendation 8.7
That the area of vegetation cleared for infrastructure development (well pads, roads and pipeline corridors) be minimised through the efficient design of flowlines and access roads, and where possible, the co-location of shared infrastructure by gas companies.

The project will develop measures for the design of roads and pipelines that may be useful in minimising impacts on biodiversity in the Beetaloo Sub-basin.

Recommendation 8.9
That to compensate for any local vegetation, habitat and biodiversity loss, the Government develops and implements an environmental offset policy to ensure that, where environmental impacts and risks are unable to be avoided or adequately mitigated, they are offset.

The project will develop a map that identifies habitat connectivity for the study area. This mapping could potentially be useful in the design of environmental offsets policy by identifying areas of high conservation value that can be rehabilitated or otherwise managed as part of offsetting arrangements.

Recommendation 8.10
That gas companies be required to identify critical habitats during corridor construction and select an appropriate mechanism to avoid any impact on them.
The project will examine the negative effects from fragmentation across a range of vegetation communities. It will assess the vulnerability of key groups of plants and animals to fragmentation and map the occurrence of these areas in the focal area of the Beetaloo Sub-basin. The mitigation measures the project develops will be available for consideration by gas companies when developing gas fields.

Recommendation 8.11
That clearing for corridors, well pads and other operational areas be kept to a minimum, that pipelines and other linear infrastructure be buried (except for necessary inspection points), and that all disturbed ground be revegetated.
The project will develop guidelines for mitigating the impacts of clearing for corridors which will minimise impacts to habitats and species.

Methodology

The study area in the Beetaloo Sub-Basin and is shown in Figure 1 below. Logistic and budget constraints prevent the project from examining the entire Beetaloo Sub-region; however, current development scenarios (derived from the Geological and Bioregional Assessment project; Huddlestone-Holmes et al. 2020) and infrastructure planning (KPMG 2019) strongly indicate that the study area includes areas of high gas prospectivity and will undergo the most immediate and extensive road construction. Furthermore, the proposed project area contains a wide range of vegetation communities including some that have been identified as being potentially ‘at risk’ from fragmentation. These vegetation communities consist of lancewood and bullwaddy woodland, open forest and thickets. These communities appear to support the highest concentrations of species ‘at risk’ from linear corridors and are the vegetation communities most exposed to the disruption of important ecological processes and to threats including weed invasion and fire suppression. They are ecologically productive and seasonal refuges for wildlife. These communities rely on large patch sizes to provide resilience to wildlfire and, thus, are considered to be vulnerable to the effects of fragmentation.

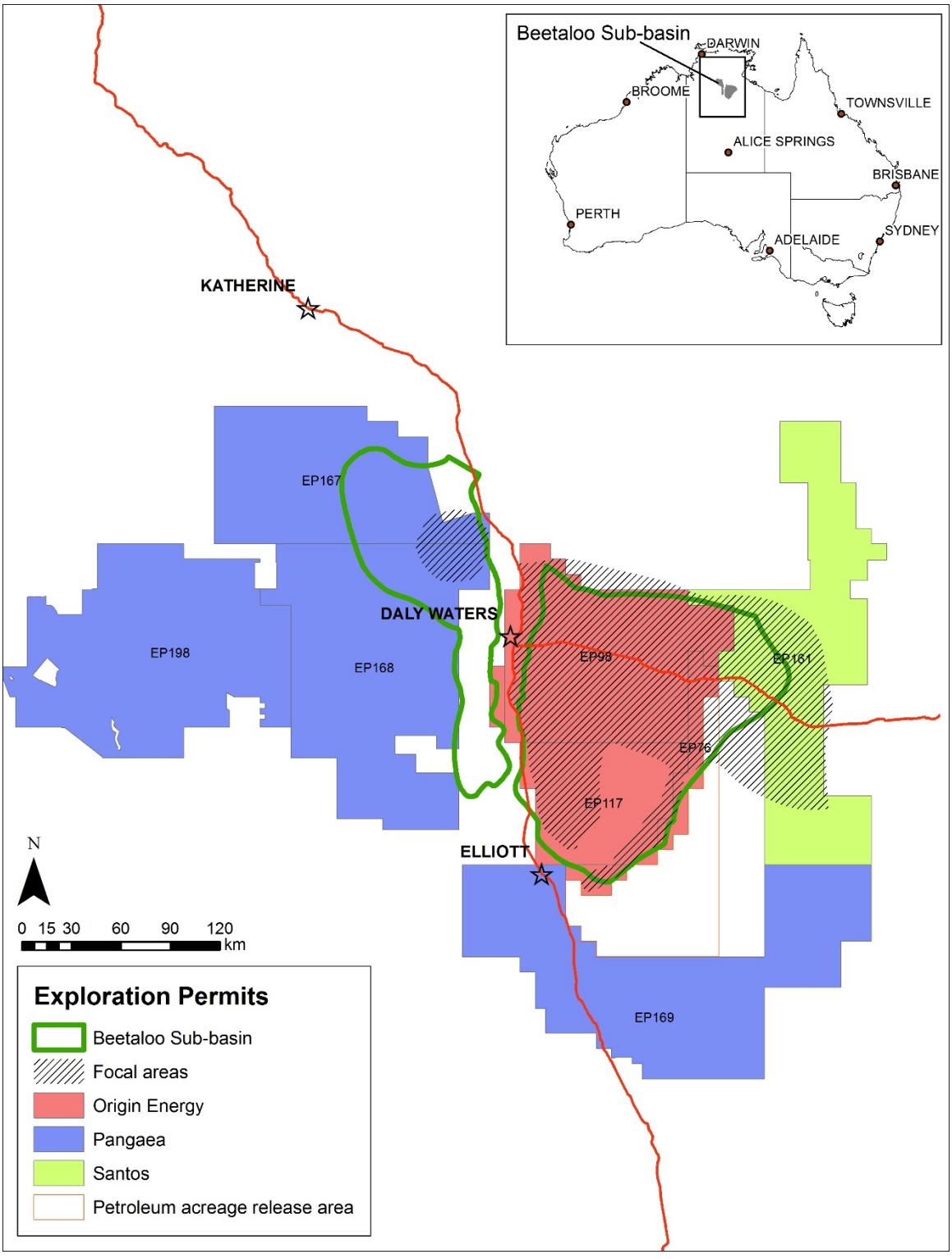

Figure 1. Map of study area with the Beetaloo Sub-Basin

Patch mosaics and edge effects

Both these processes will be assessed in module one by paired sampling of intact and fragmented landscapes. This study will quantify the occurrence and composition of plants and animals in patches of differing size and with differing levels of fragmentation. The work will focus on vascular plant species of conservation concern (especially those that are culturally significant) and on lizards, birds and microbats. Sampling will involve plot-based assessment of plants, harp trapping of bats, funnel trapping of lizards, 20-minute active searches for birds and incidental sightings of all fauna.

Roads and pipelines as barriers to movement and sources of reduced plant growth and animal mortality

In module two, the movements of several wide-ranging species of terrestrial vertebrate of conservation concern will be studied in the field using techniques such as radio telemetry, grids of camera traps and light tags. The focal animals for this work are to be determined but potential candidates are: a species of microbat with slow flight (lesser long-eared bat), a suite of ground-dwelling birds (apostlebird, hooded robin, grey-crowned babbler) and terrestrial geckoes. An assessment of road mortality of animals and dust impacts of vascular plants on roads of differing width, traffic volumes and disturbance levels will be undertaken. The roads include the Stuart Highway, Carpentaria Highway, and several minor roads. The work will examine existing impacts in order to predict how impacts may increase with development of an onshore gas industry that will result in road widening, increased traffic volumes and increased extent of the road network The assessment of road mortality will focus on macropods (spectacled hare-wallaby, northern nailtail wallaby, agile wallaby) and medium to large reptiles (dragons, monitors, snakes). The assessment of dust impacts will select several species of plants that are most likely to be 'at risk' from dust impacts, specifically those plants with low stature, rigid branches and leaves, sunken stomata, and with a covering of wax or hairy leaves and branches (Matsuki et al. 2016).

Connectivity map of the study area

Scientific understanding gained from modules one (patch mosaics and edge effects) and two (roads and pipelines as barriers), will be combined with GIS mapping approaches to develop a connectivity map for the study area within the Beetaloo Sub-basin. Mapping will be based on imagery provided by a range of methods including spaceborne LiDAR, single aperture radar (SAR) and more traditional multi-spectral imagery (from Landsat and Sentinel satellites). Initially the map will show the distribution of 'at risk' habitat within the study area based on information on patch mosaics, edge effects and movement ecology obtained during the fieldwork. Information on the location of existing and proposed new roads and pipelines will then be overlain on this map to identify areas of the landscape that will be 'at risk' from development. The data obtained from the road mortality and dust impacts study will identify the species most 'at risk' from the increases in linear transport infrastructure.

Mitigation measures

The data on the areas and species most at risk from the development of roads and pipelines will be used in module four to develop potential measures for mitigating risk and to propose potential policy settings incorporating this information. Mitigation measures will be based on an assessment of existing research worldwide and will include

consideration of: wildlife-sensitive road and pipeline designs (recommendations for maximum widths, and maximum density), establishment of wildlife crossings (overpasses including for bats, underpasses, concrete ditches for reptiles and amphibians, wildlife exclusion fencing), and identification of areas needing habitat restoration to bring back habitat connectivity.

The outputs from this research will be communicated to the community through a range of methods including factsheets, media releases and web-based products. The focus of this communication will be on how the project findings address the recommendations of the *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory* (2018).

5. Project Inputs

Research

The Final Report of the Scientific Inquiry into Hydraulic Fracturing noted that little is known about the risks from habitat fragmentation and edge effects due to vegetation loss along linear corridors in the Northern Territory (page 198). Previous work on fragmentation in Eucalypt-dominated woodlands has been undertaken around Darwin on a limited spatial scale as a Masters Research project at Charles Darwin University by Brooke Rankmore (Rankmore and Price 2004, Rankmore 2006). Nothing is known regarding the impacts of habitat fragmentation and edge effects in the Beetaloo Sub-basin. This work will contribute to scientific knowledge and management approaches in the Northern Territory and will be broadly applicable across northern Australia. It will complement a wide range of research undertaken in southern and eastern Australia.

Notwithstanding this lack of published information, the work proposed in this application has been developed in consultation with a wide range of key stakeholders including industry and the Northern Territory government. The project leader (Chris Pavey) is the lead ecologist for the Beetaloo GBA project and interacts widely with industry, government and community leaders as a contributor to the Beetaloo user-panel and as a member of the Beetaloo technical working group. He also leads the integration of the Beetaloo GBA with the Beetaloo SREBA and as such has access to (and contributes to) the latest mapping products and scientific advice. Industry input and advice will be sought again, along with that of the technical reference group, to refine the project area before commencing this work.

Resources and collaborations

Researcher	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Chris Pavey	62 days	Terrestrial ecology: threatened species, impact mitigation, fauna survey	30 years	CSIRO Land and Water
Eric Vanderduys	97 days	Terrestrial ecology: fauna survey, GIS, species distribution modelling	30 years	CSIRO Land and Water
Shaun Levick	10 days	Spatial ecology: habitat condition monitoring, LiDAR, SAR, multi-spectral imagery	15 years	CSIRO Land and Water
Research Assistant (CSOF 3)	20 days	-	-	CSIRO

Subcontractors (clause 9.5(a)(i))	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Catherine Nano	40 days	Plant ecology: flora survey, threatened species monitoring and management, community ecology, Indigenous engagement	25 years	Northern Territory Government (Flora and Fauna Division)
Generic service (TBD)	5 days	Herbarium Taxonomist	N/A	NT Herbarium (Flora and Fauna Division)

GISERA
Gas Industry Social and Environmental Research Alliance

Budget Summary

Source of Cash Contributions	2020/21	2021/22	2022/23	% of Contribution	Total
GISERA	$148,461	$91,179	$0	75%	$239,640
- Federal Government	$135,317	$83,107	$0	68.36%	$218,424
- NT Government	$7,186	$4,413	$0	3.63%	$11,599
- Origin Energy	$2,534	$1,556	$0	1.28%	$4,090
- Santos	$2,534	$1,556	$0	1.28%	$4,090
- Pangaea Resources	$891	$547	$0	0.45%	$1,438
Total Cash Contributions	**$148,461**	**$91,179**	**$0**	**75%**	**$239,640**
Source of In-Kind Contribution	**2020/21**	**2021/22**	**2022/23**	**% of Contribution**	**Total**
CSIRO	$49,487	$30,393	$0	25%	$79,880
Total In-Kind Contribution	**$49,487**	**$30,393**	**$0**	**25%**	**$79,880**

Cultural Monitoring Program

The cultural monitor program is considered mutually beneficial, increases engagement and participation of the local traditional owners and provides additional safeguards against the research proponent or other fieldworkers inadvertently entering into a sacred site or other culturally sensitive area. Cultural monitors are engaged via the NLC whenever a company or operator goes out in the field.

In GISERA projects where CSIRO researchers are being escorted onto leases by company representatives who have organised permit access, those company procedures will apply.

For all other GISERA projects (particularly environmental and social projects) where CSIRO researchers are not being escorted by industry, CSIRO will work with the NLC to apply this practice.

6. Project Impact Pathway

Activities	Outputs	Short term Outcomes	Long term outcomes	Impact
Research on terrestrial biodiversity (covering patch mosaics, edge effects, movement ecology, road mortality and dust effects).	Scientific knowledge presented as reports and research papers in journals.	Increased scientific understanding of effects on biodiversity of habitat fragmentation and construction of barriers in northern Australian savannas.	Government regulators have scientific knowledge and management measures to consider when developing approaches to mitigate the overall risk to biodiversity from road and pipeline corridors and fragmentation of habitat to acceptable levels.	• Improved biodiversity management by the onshore gas industry. • Contribution to onshore gas industry obtaining social licence to operate • Improved community understanding of important factors for biodiversity conservation • Ongoing multiple use of landscapes in the Beetaloo for onshore gas and pastoralism while maintaining functioning ecosystems
Mapping of habitat connectivity in the study area.	Map of habitat connectivity.	Increased on-ground understanding of sites where risks to biodiversity will be focussed.		
Consideration of potential mitigation measures for impacts on 'at risk' habitat and species.	Information on potential approaches to mitigate the risks to biodiversity from roads and pipelines if an onshore gas industry is developed.	Address some of the key recommendations of the Scientific Inquiry into Hydraulic Fracturing in relation to terrestrial biodiversity, ecosystem function and landscape amenity.	Onshore gas industry has knowledge and tools to consider when developing mitigation measures to protect biodiversity from negative impacts from construction of roads and pipeline corridors.	
Stakeholder engagement.	• GISERA Website • Research & community workshops • Factsheets • Media appearances	Community informed about scientific findings relevant to concerns about environmental impacts of onshore gas development.	Greater trust between the community, industry, government and CSIRO.	

7. Project Plan

Project Schedule

ID	Activities / Task Title (should match activities in impact pathway section)	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
Task 1	Identify sampling sites	Eric Vanderduys	1 January 2021	31 March 2021	Nil
Task 2	Investigate patch mosaics and edge effects	Chris Pavey, Catherine Nano	1 April 2021	30 June 2021	Task 1
Task 3	Investigate movement ecology, road mortality and dust effects	Chris Pavey	1 April 2021	31 October 2021	Task 1
Task 4	Analysis of field data	Chris Pavey, Eric Vanderduys	1 November 2021	30 November 2021	Tasks, 1, 2, 3
Task 5	Map connectivity in the study area	Shaun Levick, Eric Vanderduys	1 December 2021	30 March 2022	Tasks 1 to 4
Task 6	Develop mitigation measures	Chris Pavey	1 April 2022	31 May 2022	Tasks 1 to 5
Task 7	Communication activities	Chris Pavey	1 January 2021	30 June 2022	Nil

Task description

Task 1

TASK NAME: Identify sampling sites

TASK LEADER: Eric Vanderduys

OVERALL TIMEFRAME: 1 January 2021 to 31 March 2021. The duration of this milestone has been extended to March 2021 to take into account possible delays resulting from the COVID-19 pandemic. Fieldwork/face-to-face meetings will not take place (especially with vulnerable communities or individuals) until it is safe to do so.

BACKGROUND: Suitable field sites need to be located within the Beetaloo Sub-region where studies on patch mosaics and edge effects and movement ecology, road mortality and dust effects can be undertaken. This task involves carrying out desktop assessments using GIS to locate potential areas and then to ground truth site suitability. A critical aspect of the task is to begin establishing a relationship with land managers and traditional owners through face-to-face visits.

TASK OBJECTIVES: Undertake preparations for the field component of the project including:

- Identification of suitable sites at which to undertake research on the impacts on biodiversity of fragmentation
- Permission from landowners and traditional custodians to undertake the work
- Necessary ethics approvals and wildlife permits.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: A list of suitable study sites including geospatial data and knowledge of the land managers and traditional owners of each site.

Task 2

TASK NAME: Investigate patch mosaics and edge effects

TASK LEADER: Chris Pavey, Catherine Nano

OVERALL TIMEFRAME: 1 April 2021 to 30 June 2021

BACKGROUND: This task will examine how key components of the region's biodiversity (vascular plants, lizards, birds, microbats) are influenced by the size and degree of isolation of patches of habitat (referred to as 'patch mosaics') and by the amount of habitat that shares a boundary with open vegetation (referred to as 'edge effects'). The work will be undertaken in a concentrated time period during the transition from the wet season into the early dry season.

TASK OBJECTIVES: To study the occurrence and composition of key components of biodiversity, that is considered 'at risk' from fragmentation, in patches of habitat of differing size and spatial isolation.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: The main output will be data on occurrence and relative abundance of species of vascular plants and animals (microbats, birds, lizards) in patches of vegetation of differing area and degree of spatial isolation.

The deliverables will be a database, a short report (following completion of task 4) and then a scientific research paper.

Task 3

TASK NAME: Investigate movement ecology, road mortality and dust effects

TASK LEADER: Chris Pavey

OVERALL TIMEFRAME: 1 April 2021 to 31 October 2021

BACKGROUND: To study how roads and pipelines influence the movements of and act as sources of reduced growth and increased mortality for key components of the biodiversity.

TASK OBJECTIVES: This task has three key objectives.

- To examine the movement ecology of several focal species of wide-ranging terrestrial animals in relation to potential barriers.
- To assess the level of mortality of macropods (kangaroos and wallabies) and medium to large-sized reptiles on roads of differing width and traffic volumes.
- To assess whether the levels of dust created by roads impacts the growth of focal species of plants.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: The main output will be data on: (a) movement patterns of focal species of animals in relation to roads and pipelines, (b) mortality of macropods and reptiles on roads of differing size and usage, and (c) growth rates of focal species of plants beside roads with differing amounts of dust production. The deliverables will be databases for each of these three outputs, a short report (following completion of task 4), and at least one scientific research paper.

Task 4

TASK NAME: Analysis of field data

TASK LEADER: Chris Pavey, Eric Vanderduys

OVERALL TIMEFRAME: 1 November 2021 to 30 November 2021

BACKGROUND: At the completion of the field component of the study (tasks 1, 2 and 3) the data will undergo assessment and statistical analysis prior to mapping and development of mitigation measures.

TASK OBJECTIVES: To summarise and statistically analyse the data obtained during tasks 2 and 3 to understand the underlying patterns and trends in the data.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Scientific understanding of the patterns and trends in the data obtained during tasks 2 and 3. This information will be appropriately summarised and displayed as part of a

short report outlining the results and conclusions from the field research. It will also be included in scientific research papers covering tasks 2 and 3.

Task 5

TASK NAME: Map connectivity in the study area

TASK LEADER: Shaun Levick, Eric Vanderduys

OVERALL TIMEFRAME: 1 December 2021 to 30 March 2022

BACKGROUND: The information gathered during the fieldwork undertaken in tasks 2 and 3 and processed during task 4 will be combined with existing mapping for the study area to develop a mapping product that shows habitat linkages, wildlife corridors and areas 'at risk' from road and pipeline development.

TASK OBJECTIVES: To develop a habitat connectivity map for the study area that uses the latest mapping technology to identify connectivity corridors and linkages that are 'at risk' from roads and pipelines. The intention is that the map serves as both a decision-support tool and a basis for prescribing site-specific interventions.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: A map of the study area that provides information on location of corridors of critical habitat and existing and future roads and pipelines. A scientific paper that describes the approach used in task 5.

Task 6

TASK NAME: Develop mitigation measures

TASK LEADER: Chris Pavey

OVERALL TIMEFRAME: 1 April 2022 to 31 May 2022

BACKGROUND: Task 6 brings together all the tasks undertaken to date and addresses the relevant recommendations from the Inquiry Report. Mitigation measures will be developed based on an assessment of existing research worldwide.

TASK OBJECTIVES: To develop a toolbox of measures for mitigating risk to biodiversity from the development of roads and pipelines that is applicable to the species and habitats within the study area and the Beetaloo Sub-basin more broadly. To suggest ways of incorporating this knowledge into policy settings such as offsetting guidelines.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: The main output and deliverables will be (a) a map and response matrix that recommends site-specific interventions for each site within the study area considered to be 'at risk' of negative impact from road and pipeline development, and (b) a final report for the project.

Task 7

TASK NAME: Communication activities

TASK LEADER: Chris Pavey

OVERALL TIMEFRAME: 1 January 2021 to 30 June 2022

BACKGROUND:

TASK OBJECTIVES: Preparation of a variety of communication tools with assistance from the GISERA Communications team including factsheets, media releases and communication outputs specifically designed for Indigenous communities (these will focus on results related to bush foods).

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Five communication items; one each at onset of project, month 6, month 12, month 18 and at completion of project.

Project Gantt Chart

		2020/21						2021/22											
Task	**Task Description**	**Jan-21**	**Feb-21**	**Mar-21**	**Apr-21**	**May-21**	**Jun-21**	**Jul-21**	**Aug-21**	**Sept-21**	**Oct-21**	**Nov-21**	**Dec-21**	**Jan-22**	**Feb-22**	**Mar-22**	**Apr-22**	**May-22**	**Jun-22**
1	Identify sampling sites																		
2	Investigate patch mosaics and edge effects																		
3	Investigate movement ecology, road mortality and dust effects																		
4	Analysis of field data																		
5	Map connectivity in the study area																		
6	Develop mitigation measures																		
7	Communication activities																		

8. Technical Reference Group

Experts who will be invited to participate in the Technical Reference Group are:

- Dr Tony Griffiths, Flora and Fauna Division, Northern Territory Government, Darwin
- Professor Stephen Garnett, Charles Darwin University, Darwin
- Dr Rodney van der Ree, Director, Ecology and Infrastructure International, and Technical Executive, WSP, Melbourne
- One or more technical experts from the gas industry.

9. Communications Plan

Stakeholder	**Objective**	**Channel** (e.g. meetings/media/factsheets)	**Timeframe** (Before, during at completion)
Indigenous communities within the Beetaloo sub-basin with a focus on Traditional Owners and ranger groups	To pursue relations with Indigenous communities and their key stakeholders (via cultural monitors). To communicate project objectives and key findings from the research.	Regular meetings before and during fieldwork and at the conclusion of the project (to communicate the key results). Preparation of factsheets focussed on key species of bushfood and prepared in Indigenous language.	Ongoing
Regional communities within the Beetaloo sub-basin and the wider public (including tourists)	To communicate project objectives and key findings from the research.	Preparation of fact sheets (one at commencement of project and another at its completion) that can be displayed at shops and businesses in Mataranka, Daly Waters, Larrimah, Dunmarra, Elliot and at Cape Crawford Roadhouse. Project progress reported on GISERA website to ensure transparency for all stakeholders including regional communities. Participation in roadshows, community workshops and meetings and other engagements where appropriate.	At project outset (July 2020) and completion (June 2022). As required. As required.

Government	To facilitate a deeper understanding of research findings and implications for policy, programs, and planning.	Knowledge transfer through direct meetings with government staff (including through the SREBA process) and through stakeholder workshops.	Ongoing.
Industry	To facilitate a deeper understanding of research findings and implications for operation of gas infrastructure.	Knowledge transfer through direct meetings with environmental staff and managers from gas companies and through stakeholder workshops.	Ongoing.
Research community	To present research findings to the community of environmental scientists in Australia and globally.	Present results at scientific meetings and through invited seminars at research institutions. Publish research in scientific literature.	To be decided (depending on conference timing). November 2021 onwards (completion of task 4).

10. Budget Summary

Expenditure	2020/21	2021/22	2022/23	Total
Labour	$126,722	$103,921	$0	$230,643
Operating	$40,728	$13,706	$0	$54,434
Subcontractors	$30,498	$3,945	$0	$34,443
Total Expenditure	**$197,948**	**$121,572**	**$0**	**$319,520**

Expenditure per Task	2020/21	2021/22	2022/23	Total
Task 1	$20,809	$0	$0	$20,809
Task 2	$169,010	$0	$0	$161,010
Task 3	$3,001	$46,633	$0	$49,634
Task 4	$0	$13,183	$0	$13,183
Task 5	$0	$40,900	$0	$40,900
Task 6	$0	$14,042	$0	$14,042
Task 7	$5,128	$6,814	$0	$11,942
Total Expenditure	**$197,948**	**$121,572**	**$0**	**$319,520**

Source of Cash Contributions	2020/21	2021/22	2022/23	Total
Federal Government (68.36%)	$135,317	$83,107	$0	$218,424
NT Government (3.63%)	$7,186	$4,413	$0	$11,599
Origin Energy (1.28%)	$2,534	$1,556	$0	$4,090
Santos (1.28%)	$2,534	$1,556	$0	$4,090
Pangaea (0.45%)	$891	$547	$0	$1,438
Total Cash Contributions	**$148,461**	**$91,179**	**$0**	**$239,640**

In-Kind Contributions	2020/21	2021/22	2022/23	Total
CSIRO (25%)	$49,487	$30,393	$0	$79,880
Total In-Kind Contributions	**$49,487**	**$30,393**	**$0**	**$79,880**

	Total funding over all years	Percentage of Total Budget
Federal Government Investment	$218,424	68.36%
NT Government Investment	$11,599	3.63%
Origin Energy	$4,090	1.28%
Santos	$4,090	1.28%
Pangaea Resources	$1,438	0.45%
CSIRO Investment	$79,880	25%
TOTAL	**$296,571**	**100%**

Task	Milestone Number	Milestone Description	Funded by	Start Date (mm-yy)	Delivery Date (mm-yy)	Fiscal Year Completed	Payment $ (excluding CSIRO contribution)
Task 1	1.1	Identify sampling sites	GISERA	Jan-21	Mar-21	2020/21	$15,607
Task 2	2.1	Investigate patch mosaics and edge effects	GISERA	Apr-21	Jun-21	2020/21	$126,758
Task 3	3.1	Investigate movement ecology, road mortality and dust effects	GISERA	Apr-21	Oct-21	2021/22	$37,226
Task 4	4.1	Analysis of field data	GISERA	Nov-21	Nov-21	2021/22	$9,885
Task 5	5.1	Map connectivity in the study area	GISERA	Dec-21	Mar-22	2021/22	$30,675
Task 6	6.1	Develop mitigation measures	GISERA	Apr-22	May-22	2021/22	$10,532
Task 7	7.1	Communication activities	GISERA	Jan-21	Jun-22	2021/22	$8,957

11. Intellectual Property and Confidentiality

Background IP (clause 11.1, 11.2)	**Party**	**Description of Background IP**	**Restrictions on use (if any)**	**Value**
				$
				$
Ownership of Non-Derivative IP (clause 12.3)	CSIRO.			
Confidentiality of Project Results (clause 15.6)	Project Results are not confidential.			
Additional Commercialisation requirements (clause 13.1)	Not Applicable.			
Distribution of Commercialisation Income (clause 13.4)	Not Applicable.			
Commercialisation Interest (clause 1.1)	**Party**		**Commercialisation Interest**	
	CSIRO		Not Applicable	
	Origin Energy		Not Applicable	
	Santos		Not Applicable	
	Pangaea Resources		Not Applicable	

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