Project Order, Variations and Research Progress

Project Title: Mapping future transport passages and volumes for improved planning and operation

This document contains three sections. Click on the relevant section for more information.

1 Original Project Order

Project Order

Proforma 2020

1. Short Project Title

Mapping future transport passages and volumes for improved planning and operation

Long Project Title	Mapping future transport passages and volumes for improved planning and operation
GISERA Project Number	S.16
Proposed Start Date	01/07/2020
Proposed End Date	30/06/2021
Project Leader	Caroline Bruce

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

This project will provide a 'pre- and peak' analysis of the freight costs (road and rail), flows and impacts for identified sites or regions in the NT Beetaloo Basin for scenarios of the construction phase and operational phase of gas development. It will also test a range of interventions that may reduce transport costs, transported related environmental impacts (e.g. dust, noise, erosion) to the landscape and community, and increase road safety. This will provide information to support decision making across industry, government regulation and community. This includes: freight task increase from current baseline, transport costs, Carbon Dioxide equivalent (CO2e) impacts, road maintenance impacts, and impacts of dust on agriculture and human health, and local business activities adjusting where necessary. The analysis will consider existing traffic across the road and rail network as well as introduced traffic (heavy and domestic vehicles). The development of a transport assessment model for these indicators at pre- and peak construction and operational phases will allow locations of the greatest impacts (or of high risk) to be identified across the network. It will allow comparison between sites and provide a capability to model various interventions (by industry or government) to reduce these risks or impacts.

This project will:

- Improve industry and community awareness of freight impacts of shale and gas industry in Beetaloo Basin across the transport network, and capacity to test and compare interventions to improve freight outcomes.
- Improve connectivity for communities and access for movements through complementary benefits of infrastructure investments, better use of rail for heavy freight.
- Provide an ability to manage the outcomes to human health and the economy from a clearer understanding of the impacts of transport related dust. Further the ability to look into regional development co-investment opportunities.

This study will assist with preliminary information that can be used for **Recommendations 8.16, 8.11 and 8.13** of the *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory* (2018).

Description

The Transport Network Strategic Investment Tool (TraNSIT) maps freight movements between origins and destinations across Australia. It covers 129 commodities over 650,000 supply chain paths and millions of annual vehicle and rail trips. The tool has been used extensively by the Australian Government to inform road and rail

investments such as the Northern Australia Beef Roads Programme and Inland Rail, through estimating the transport impacts from investments (www.csiro.au/TraNSIT).

Importantly, TraNSIT can be used to estimate impacts from increased transport volumes across the road and rail network from major activities such as new production and mines. In this project, TraNSIT will provide a 'pre- and peak' analysis of the transport costs, flows and impacts for identified sites or regions in the NT Beetaloo Basin for the construction phase and operational phase. To develop an accurate representation of the 'pre- and peak' analysis, the project team will work closely with the Technical Reference Group and industry (Origin Energy, Santos and Pangaea) to identify and map volumes of each commodity (e.g. pipes, quarry material, personnel, etc) to be transported between origins and destinations by time of year, along with any special freight considerations (e.g. defined freight paths for sensitive commodities).

Modelled transport costs include freight costs for each supply chain route, costs per tonne-km, travel time, travel distance, disaggregated by commodity, vehicle type, direction and cost components (driver, maintenance, tyres, fuel etc). Freight flows include number of vehicles on each road and rail segment and routes by time of year, disaggregated by commodity, vehicle type, direction. Results will be disaggregated by location (road and rail segment), transport activity and supply chain. For the construction phase, the analysis will incorporate transport of materials (e.g. water, pipes, quarry materials) to the well sites, gathering pipes, water and gas processing plants; and transport of personnel. It will consider the use of rail, including any required investments in spur lines and loading/unloading facilities. The modelled data will serve as a benchmark to inform community (via forums hosted by the Technical Reference Group), government and industry on the impacts for the mining activity above existing freight volumes and identify both the critical locations for high impact and options for investment. The existing TraNSIT model will provide transport costs and flows for optimal road/rail transport routes along the supply chain, identifying bottlenecks and other geographical limitations (e.g. restrictions on transport through high value conservation sites) based on the current transport infrastructure. As part of the project, the TraNSIT tool will produce several outputs and analysis applicable to mega-projects:

1. Erosion and maintenance impacts for roads due to heavy vehicle transport used during the operational life of the shale and gas infrastructure and its construction.
2. Dust and noise impacts on agricultural and human health, accommodating existing road surfaces and proximity to farms and the build environment.
3. Consideration of transport modes at different locations, such as shifting road to rail, that may not reduce transport costs, but improve safety, reduce road damage, noise etc.
4. Interventions to allow transfers between road and rail, such as rail spurs and loading/unloading facilities at key locations; changes to regulation restrictions for transport of some materials or vehicle

types along certain routes (e.g. through high value conservation areas); road upgrades to reduce costs of transport along preferred routes.

Outputs will include a report containing:

- Freight density maps showing the freight volumes (by vehicle type and commodity) across the road and rail network before and at peak construction and operational phases of shale and gas at the NT Beetaloo Basin. This will allow visual identification of locations most impacted, underpinned by quantitative impacts for road maintenance, noise and so on.
- Transport costs for different rail options along the Darwin to South Australia rail link, including option for utilising backloading capacity.
- Summary tables providing transport impacts for each road/rail link.
- Results from a range of interventions (e.g. road upgrades, road access restrictions, substituting rail for road) which provide transport cost and freight volume impacts. Results will be disseminated back to government and industry via the Technical Reference Group and community forums hosted by the government representatives.

Need & Scope

The construction phase of onshore gas projects can impact significantly on the regional road network through a significant increase in vehicle numbers along many roads. This can cause major road damage (particularly to local roads), noise and dust. This project provides an opportunity to map out the likely impacts of different onshore gas wells across the NT road and rail network before construction. This will allow the Australian and NT Governments to use evidence-based information to plan interventions that would reduce the traffic impacts from additional onshore gas development.

The outputs from this project will provide important freight, economic and environmental information to governments, community and industry on the impacts of heavy vehicle transport on the community and road infrastructure for the life of the mine. Through forums hosted by the members of the Technical Reference Group, community will have access to useful outputs such as impact on freight volumes (vehicles per day) and type of vehicles across the road, how rail infrastructure will be used to reduce freight on roads, as well as benefits and dis-benefits of interventions. Outputs can be presented in easy-to-interpret formats (maps, tables) for each location.

The data will be disaggregated by gas infrastructure construction stages, location, transport activity and supply chain, allowing for the critical impact areas to be identified. Further, the project will allow alternative sites to be compared and modelling of mitigation, investment or regulations scenarios for the high-impact transport activities.

NT Hydraulic Fracturing Inquiry Recommendations

The Inquiry found that there has been no formal analysis of the feasibility of the use of rail transport to deliver some supplies to gas regions and reduce road transport requirements. Pangaea have suggested that the existing Adelaide to Darwin railway line might be an option to do this.

This study will assist with preliminary information that can be used for Recommendation 8.16:

That the Government assesses the impact that any heavy-vehicle traffic associated with any onshore shale gas industry will have on the NT's transport system and develops a management plan to mitigate such impacts. Consideration must be given to:

- *forecast traffic volume and roads used;*
- *the feasibility of using the existing Adelaide to Darwin railway line (or some other railway*
- *network) to reduce heavy-vehicle road use; and*
- *road upgrades.*

The study will also provide useful information to be used for Recommendations 8. 11 and 8.13 recommending clearing for infrastructure be kept to a minimum to reduce risks of erosion, weed transport and biodiversity loss.

Methodology

The project will be completed in five phases:

Phase 1 – Apply the Transport Network Strategic Investment Tool (TraNSIT) to produce a baseline map of freight volumes across the road and rail network. This baseline will be validated with the NT Government for accuracy and will be used as a benchmark. This phase will also include additional indicators to be used to understand and measure cost and benefits of pre-and peak transport situations against changes different scenarios.

Phase 2 - Capture the logistics processes, construction phase inputs and their sources, freight task and supply chains throughout the life of the onshore gas project through a series of workshops and interviews with industry and government stakeholders. Phase 2 will provide an understanding of the material, waste and personnel transport requirements, and corresponding supply chain paths for the onshore gas well options.

Parallel to phase 1 and phase 2, there will be an activity to model impacts from dust, this will be a new indicator for the TraNSIT model.

Phase 3 - Use TraNSIT to model the annual and monthly heavy vehicle and personnel movements across the NT road network (including trips into and out of the NT) based on the transport requirements defined in Phase 1. By mapping the movements across the road network, TraNSIT will estimate the pre versus peak impacts of the transport activities and produce a wide range of outputs to underpin them. TraNSIT is a modularised tool developed by CSIRO where data for a supply chain, processes and infrastructure are inputs to the core engine. The tool produces a range of decision support outputs.

Phase 4 - Liaise with stakeholders via the Technical Reference Group to validate the modelling outputs and identify interventions that may reduce the impacts from the transport task, followed by communication to relevant stakeholders.

Phase 5 - Use TraNSIT to test a range of intervention options identified by NT Government, local governments and other stakeholders. The analyses will test the impact of these interventions on freight volumes, transport costs, road damage and dust. The aim of testing these interventions is to provide government with evidence-based information to target investments or regulatory changes. Interventions can be prioritised by industry and government for future funding submissions under government investments schemes (e.g. Roads for Strategic Importance, Bridge renewal programme). More strategically, they will also be communicated to Infrastructure Australia and the National Freight and Supply Chain Strategy as part of longer-term transport capacity planning.

At some point during the 12-month project, an analysis may be requested by key stakeholders where results, or an interim report, are required before the scheduled milestone dates of the Phases or tasks. Such "Accelerated Analysis" can be conducted subject to required inputs and metrics being developed or available early enough. In addition, the TraNSIT Web tool can be made available to all participants and may allow some scenario development and to understand current road and rail use

The metrics and variables used in the transport analysis are:

1. *Transport economics* – For each vehicle and train trip -freight costs (including cost components), costs per tonne-km, travel time, travel distance, commodity, vehicle type (rigid, semi-trailer, B-Double, A-Double etc), direction, CO2 emissions, and additional indicators- noise, road damage/maintenance, dust effects. By aggregating across vehicle trips – transport costs for a supply chain path or road corridor, total costs for commodity and time of year.
2. *Transport flows*: Vehicles counts on each road and rail segment and routes by time of year, disaggregated by commodity, vehicle type, direction, tonnes-km on each route. Other indicators by road segment.

5. Project Inputs

Research

Previously, business cases submitted to state/territory or Federal Governments for transport-related infrastructure investments usually used a linear method to estimate the incremental changes to Average Annual Daily Traffic (AADT). Recent applications of this approach include the Inland Queensland Roads Action Plan (IQ-RAP 2016), the Austroads study "Identification of Risk Indicator to Support Life Line Freight Routes" (Austroads 2016) and CSG in Queensland (Department of Environment and Heritage Protection 2013). Methods based on AADT volumes are simple to use, quick to apply and do not require knowledge about industry supply chains. Further, they consider all road users, not just those associated with a specific industry such as agriculture or forestry. However, the cost-benefit methods using AADT volumes have major limitations. Firstly, they usually do not discern the commodity being transported on heavy vehicles. Secondly, they usually do not consider vehicle counts at different points of the road corridor, i.e. consideration that vehicles enter and exit at different points of the road corridor, and the point on the road where AADT volumes are detected may not be representative of vehicle counts on other parts of the road. Thirdly, AADT volumes are usually not available for all roads, particularly minor and roads managed by local government. Lastly, they are not predictive as they cannot consider change in road usage (such as seasonal conditions) or supply chain paths and freight flows across the network in the event of a road upgrade.

TraNSIT takes a different approach to the above methods through a ground-up approach utilising detailed industry data at enterprise level. The method focuses on transport between enterprises, providing the most granular analysis possible whilst providing a dynamic representation of commodity transport paths at different locations and accounting for seasonal production. It represents all movements between commodity enterprises, capturing industry-specific characteristics of the transport network, vehicle movements and supply chains structures. Transport logistics and costs between enterprises are calculated by simulating and optimising individual truck and rail trips using detailed vehicle/train models that accommodate likely driver routes, vehicle choice capabilities or other complicated operational logistics that are linked to the infrastructure. For example, if a small road segment in a higher mass vehicle (e.g. B-double truck) road corridor is limited to a lower capacity vehicle (e.g. semi-trailer truck), the driver has the choice of decoupling or taking a detour, with a different cost for each choice. TraNSIT was primarily developed to estimate transport-related cost savings for infrastructure investment at the highest level of detail along major and minor freight routes (e.g.

minor/local roads, last mile), while accommodating additional transport impacts associated with changes to the supply chain and transport path/vehicle/mode that may occur after implementation of the investment. Infrastructure investment which can be modelled in TraNSIT includes road/rail upgrades; incorporation of higher-productivity vehicles; creation of freight hubs, processing or storage facilities; and regulatory changes.

The use of TraNSIT by all three levels of government has rapidly expanded in the last five years, due to its advantage over previous methods, and independence. Major applications where the research has had direct input include the Northern Australia Beef Roads Programme, Inland Rail, and Roads of Strategic Importance. TraNSIT is also noted as a key tool to inform future investments in the Infrastructure Australia - Infrastructure Plan. TraNSIT is already deeply entrenched in government methodologies for transport-related infrastructure planning, and Australian and state/territory governments have signed up for long term use of TraNSIT Web. The primary benefit for this project is pathway to impact, since the key senior stakeholders in government are already supportive of and use TraNSIT.

Resources and collaborations

Researcher	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Andrew Higgins	26 days	Operation research and transport analysis, project leadership	23	CSIRO
Stephen McFallan	20 days	Statistics, mathematical modelling, programming, built environment, (in a variety of domains)	25	CSIRO
Caroline Bruce	30 days	Geography, GIS, project coordination	20	CSIRO
Artiom Bondarenco	40 days	Artificial intelligence, modelling, software development, spatial analysis	10	CSIRO
Adam McKeown	15 days	Modelling	20	CSIRO

Subcontractors (clause 9.5(a)(i))	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Nil				

GISERA
Gas Industry Social and Environmental Research Alliance

Budget Summary

Source of Cash Contributions	2020/21	2021/22	2022/23	% of Contribution	Total
GISERA	$145,731	$0	$0	75%	$145,731
- Federal Government	$132,829	$0	$0	68.36%	$132,829
- NT Government	$7,053	$0	$0	3.63%	$7,053
- Origin Energy	$2,487	$0	$0	1.28%	$2,487
- Santos	$2,487	$0	$0	1.28%	$2,487
- Pangaea Resources	$874	$0	$0	0.45%	$874
Total Cash Contributions	**$145,731**	**$0**	**$0**	**75%**	**$145,731**

Source of In-Kind Contribution	2020/21	2021/22	2022/23	% of Contribution	Total
CSIRO	$48,577	$0	$0	25%	$48,577
Total In-Kind Contribution	**$48,577**	**$0**	**$0**	**25%**	**$48,577**

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 organized 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
1) Produce validated baseline and indicators	Baseline of current freight movements across the NT road/rail network, including critical link analysis of supply chains into other states/territories. Validate with NT Government. Parameterization of non-transport costs indicators (e.g. impacts from dust) to be included into the analysis.	Current NT transport task understood by stakeholders. Set of indicators identified and modelled for inclusion in the analysis.	Improved capacity to make more informed infrastructure investments accommodating pre- and peak "shale and gas" freight along the road and rail network. Integration of freight analysis and related knowledge base into TraNSIT and TraNSIT Web, which the Australian and NT Governments have signed up to and will be used for road and rail investment packages announced by the government.	Reduced costs of transport & handling at the construction and operational phases by an estimated 20% and reduced transport related environmental impacts from well informed infrastructure investments Improved connectivity for communities and access for tourist movements through complementary benefits of infrastructure investments, better use of rail for heavy freight. Improved targeting of
2) Mapping of logistical processes and supply chains for construction and operational phases of shale and gas at the NT Beetaloo Basin	Meetings held with the Technical Reference Group, industry (Origin Energy, Santos and Pangaea) and government to identify volumes and timing of each type of material and waste to be transported between origins and destinations, including planned use of rail, backloading, and any special freight path and vehicle type restrictions. A freight and supply chain map validated with industry and ready for implementation into TraNSIT.	Conceptual map of freight and personnel movements produced and validated by the Technical Reference Groups.		
3) Transport impacts of shale and gas in the Beetaloo Basin	Application of TraNSIT to construction and operational phases, determining impacts of freight volumes, economics and other indicators at peak construction and operation compared to pre-construction. This includes number of vehicle (freight and personnel) and rail movements across the transport network (annually and monthly), and transport costs. Critical link analysis showing the extent of the supply chains into other states. Pinch point analysis to identify transport bottlenecks or inefficiencies from the construction or operational phases. Production of an interim report.	Common understanding amongst industry and government as to the freight impact and bottlenecks due to shale and gas in the Beetaloo Basin	Improved industry and community awareness of freight impacts of shale and gas in Beetaloo Basin across the transport network, and capacity to test and compare interventions to improve freight outcomes.	

4) Validation of results and identification of interventions	Communication of results to industry and government stakeholders for range of indicator outputs, identifying any transport, safety, environmental or community issues in the vicinity of the transport network. Identification of infrastructure, regulatory or operational interventions that may reduce transport costs (e.g. use of rail, road improvements, hub and spoke, etc) or generate co-benefits for communities and tourism			Australian Government, NT Government and industry investments through current and future funding schemes (e.g. Roads of Strategic Importance) Reduced transport costs that accommodate impacts to sensitive biodiversity areas.
5) Modelling of intervention options and submission of final report	Application of TraNSIT to the range of intervention options identified in step 4, to identify transport cost savings, freight volume impacts by mode and impacts to the other indicators (e.g. dust, emissions, connectivity to communities, traffic shifted to rail). Results of interventions communicated to the industry, Australian and NT Governments and used in business cases as evidence-based information for infrastructure improvement programs. Key findings communicated to community via forums hosted by government representatives in the technical reference group. Final report submitted	Prioritisation of interventions for government and private funding, and business cases developed for infrastructure improvements programs for northern Australia. Integration of data and knowledge (generated in the project) into TraNSIT Web, for future applications by the NT and Australian Government for infrastructure planning.	Extension of knowledge base and analysis capability to other shale and gas exploration project in Australia, reducing the lead time and transaction costs conduction similar transport and logistics analysis.	

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	Produce baseline and indicators	Stephen McFallan	1 July 2020	30th August 2020	nil
Task 2	Mapping of logistical processes and supply chains for construction and operational phases of shale and gas industry in Beetaloo Basin	Andrew Higgins	1 August 2020	31st October 2020	1
Task 3	Transport impacts of shale and gas in Beetaloo Basin, including additional indicators	Stephen McFallan	1st November 2020	31st January 2021	2
Task 4	Validation of results and identification of interventions	Andrew Higgins	31st January 2021	28 February 2021	2
Task 5	Modelling of intervention options and submission of final report	Stephen McFallan	1st March 2021	30th June 2021	4

A request for an "accelerated analysis" by key stakeholders may require some outputs of these tasks to be moved forward. After the completion of Tasks 1 and 2, some analysis for Tasks 3 to 5 can be brought forward if there is a need for early results. For example, in Task 5, an intervention option can be analyzed before March 2021, if the intervention option has been defined by stakeholders earlier on.

Task description

Task 1

TASK NAME: Produce baseline and produce indicators

TASK LEADER: Stephen McFallan

OVERALL TIMEFRAME: 1 July 2020 to 30 August 2020

BACKGROUND: To understand the transport related impacts for shale and gas in the NT Beetaloo Basin, a "pre" baseline needs to be produced showing what is the current freight across the road and rail network.

TASK OBJECTIVES: To produce a baseline of freight and personnel transport in the Beetaloo Basin, for comparison with 'peak' construction and production scenarios.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Baseline of current freight movements across the NT road/rail network, including critical link analysis of supply chains into other states/territories. The baseline analysis will consist of a range of road and rail freight maps for NT, along with transport economics of each commodity class. The freight maps will show the number of vehicles and rail wagons along each segment of the network, including direction, vehicle type, supply chain leg, etc. This will provide stakeholders with a common understanding of what is currently moving around the NT road and rail networks. TraNSIT already contains the freight movements by commodity for all trips in, out and through the NT. By consulting with industry and government, other key transport-related indicators (e.g. road damage, dust, connectivity for other road users and communities, sensitive freight paths) will be identified and methods for including in TraNSIT.

Task 2

TASK NAME: Mapping of logistical processes and supply chains for construction and operational phases of shale and gas industry at the NT Beetaloo Basin

TASK LEADER: Andrew Higgins

OVERALL TIMEFRAME: 1 August 2020 to 31 October 2020

BACKGROUND: Before the transport impacts of shale and gas can be estimated, there needs to be an understanding of the volumes and types of materials that are needed at the wells for construction and operational phases. This can only be identified through discussions with the key industry stakeholders.

TASK OBJECTIVES: To develop a supply chain map of freight for the pre-and peak phases of shale and gas industry at the NT Beetaloo Basin, which can then be used to parameterize the inputs for TraNSIT.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Meetings held with industry (Origin Energy, Santos and Pangaea) and government to identify volumes and timing of each type of material and waste to be transported between origins and destinations, including planned use of rail, backloading, and any special freight path and vehicle type restrictions. This will likely involve movements into and out of NT, and across three modes of transport. Sensitive freight will be identified along with special considerations with approved freight paths,

transport methods. A freight and supply chain conceptual map will be produced and validated with industry and ready for implementation into TraNSIT.

Task 3

TASK NAME: Transport impacts of shale and gas industry at the NT Beetaloo Basin

TASK LEADER: Stephen McFallan

OVERALL TIMEFRAME: 1 November 2020 to 31 January 2021

BACKGROUND: The Transport Network Strategic Investment Tool (TraNSIT) will be used for the analysis. TraNSIT has a long track record or informing infrastructure investments in the NT and across Australia, and the TraNSIT team has developed a strong rapport with senior management in the key NT departments, particularly the Department of Infrastructure, Planning and Logistics. TraNSIT has previously been applied to CSG construction phase in Queensland, which was of benefit to the Queensland Department of Transport and Main Roads. The conceptual map of freight and personnel movements from Task 2 will be an input to this transport analysis.

TASK OBJECTIVES: To derive and communicate the transport related impacts from shale and gas industry

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Application of TraNSIT to peak construction and operational phases, showing impacts of freight volumes, economics and other indicators compared to the before scenario. This includes number of vehicle (freight and personnel) and rail movements across the transport network by time of year, transport costs. Critical link analysis showing the extent of the supply chains into other states. Pinch point analysis to identify transport bottlenecks or inefficiencies from the construction or operational phases. Outputs will include a variety of spatial freight mapping, transport economics and analysis for each of the identified indicators. An interim report will be produced for communication of results.

Task 4

TASK NAME: Validation of results and identification of interventions

TASK LEADER: Andrew Higgins

OVERALL TIMEFRAME: 31 January 2021 to 28 February 2021

BACKGROUND: A large range of graphical and tabular outputs will be produced from the TraNSIT analysis of shale and gas industry in the NT. Before testing interventions, these outputs need to be validated to ensure confidence and support is secured for the intervention options.

TASK OBJECTIVES: Report back to industry and government with the draft results, and gaining their expert input with regards to any errors. This will also socialise the results across the stakeholders and help understand the types of interventions that would be effective and/or supported by government.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Communication of results to industry and government stakeholders for range of indicator outputs, identifying any transport, safety, environment or community

issues in the vicinity of the transport network. This will be done with one-on-one meetings with industry and government, and a round table discussion with broader stakeholders. Identification of infrastructure, regulatory or operational interventions that may reduce transport costs (e.g. use of rail, road improvements, hub and spoke, etc) or generate co-benefits for communities and tourism. Specific details of the intervention options will need to be obtained so that the logistics can be accurately incorporated into TraNSIT. For example, if rail was to be used for some inputs, we would need to know which commodities, where are they loaded, rolling stock requirements, etc.

Task 5

TASK NAME: Intervention options and report

TASK LEADER: Stephen McFallan

OVERALL TIMEFRAME: 1 March 2021 to 30 June 2021

BACKGROUND: Once the intervention options are identified they can be evaluated in TraNSIT

TASK OBJECTIVES: Evaluate the intervention options using TraNSIT, presentation of outputs to stakeholders and path to implementation. Upon request, some intervention options can be evaluated earlier than March 2021, provided they have been defined by stakeholders.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Application of TraNSIT to the range of intervention options, to identify transport cost savings, freight volume impacts by mode and benefits to the other indicators (e.g. dust, emissions, connectivity to communities, traffic shifted to rail. Results of interventions communicated to the industry, Australian and NT Government and used in business cases as evidence-based information for infrastructure improvement programs. Key groups in the NT Government and Australian Government (DITCRD), e.g. Infrastructure Investment Division, will be included in the presentation of the methodology and results. Case studies will also be communicated to Infrastructure Australia and the National Freight and Supply Chain Strategy, to demonstrate how infrastructure investments in shale and gas can provide national level benefits. Results from the project will be included in TraNSIT Web for ongoing use by NT Government and Australian Government. Final report submitted.

Project Gantt Chart

		2020-2021											
Task	**Task Description**	**Jul-20**	**Aug-20**	**Sept-20**	**Oct-20**	**Nov-20**	**Dec-20**	**Jan-21**	**Feb-21**	**Mar-21**	**Apr-21**	**May-21**	**Jun-21**
1	Produce baseline and indicators												
2	Mapping of logistical processes and supply chains for construction and operational phases of shale and gas industry in Beetaloo Basin												
3	Transport impacts of shale and gas industry in Beetaloo Basin, including additional indicators												
4	Validation of results and identification of interventions												
5	Modelling of intervention options and submission of final report												

8. Technical Reference Group

The TRG's role will be to ensure the modelling of the 'peak' construction/operation scenario is an accurate reflection of the logistics in practice and key messages are accurately disseminated to stakeholders. The project team already has long term working relationships with most suitable members of the TRG. Rather than meeting with the full TRG formally (e.g. round tables), the project team will liaise with each agency, association and industry organisation separately.

Suggested membership of the TRG is:

- NT Government – Department of Infrastructure, Planning and Logistics (Civil Assets Management team – Shane Tepper) – input into existing planned investments for the road network. The project team already has a good working relationship with several groups in this department and an active project extending TraNSIT Web to NT. Broader NT Government representation through the departments of Primary Industries and Resources as well as Trade, Business and Innovation. Introduction to suitable representatives will be sought at the project start
- Office of Northern Australia
- Onshore gas industry and GISERA members
- Northern Territory Chamber of Commerce
- DITRDC - Infrastructure Investment Division – North West Roads
- NT Road Trains Association – based at Darwin – Represents road transport in NT, including safety and performance. The project team has a good working relationship with the CEO Louise Ballato.

9. Communications Plan

Stakeholder	**Objective**	**Channel** (e.g. meetings/media/factsheets)	**Timeframe** (Before, during at completion)
Regional community / wider public	To communicate project objectives and key messages from the research	Fact sheets (including development of one at commencement of project which will explain in plain English the objective of the project – this will be updated periodically as project progresses). Project progress reported on GISERA website to ensure transparency for all stakeholders including regional communities. Media release (optional)	From commencement of project and with updates as they come to hand. As required At completion
All non-government – industry, councils, landowners	Communicate goals of the project	Round table workshops in Darwin plus fact sheet	Within 4 weeks of project commencement
Australian and NT Government	Interim report – before and after analysis, plus announcement of results	Communication at workshop, short report for distribution	Month 7
TRG plus government	Identify intervention options	Round table workshop in Darwin	Month 6
Australian and NT Government and GISERA industry partners	Present research findings	Present results at knowledge transfer session (arranged by GISERA office)	Month 12
Regional community/wider public, government, scientific community and industry	To report on key findings	Public release of final report	At project completion

10. Budget Summary

Expenditure	2020/21	2021/22	2022/23	Total
Labour	$175,308	$0	$0	$175,308
Operating	$19,000	$0	$0	$19,000
Subcontractors	$0	$0	$0	$0
Total Expenditure	**$194,308**	**$0**	**$0**	**$194,308**

Expenditure per Task	2020/21	2021/22	2022/23	Total
Task 1	$26,732	$0	$0	$26,732
Task 2	$38,692	$0	$0	$38,692
Task 3	$36,968	$0	$0	$36,968
Task 4	$28,294	$0	$0	$28,294
Task 5	$63,622	$0	$0	$63,622
Total Expenditure	**$194,308**	**$0**	**$0**	**$194,308**

Source of Cash Contributions	2020/21	2021/22	2022/23	Total
Federal Government (68.36%)	$132,829	$0	$0	$132,829
NT Government (3.63%)	$7,053	$0	$0	$7,053
Origin Energy (1.28%)	$2,487	$0	$0	$2,487
Santos (1.28%)	$2,487	$0	$0	$2,487
Pangaea (0.45%)	$874	$0	$0	$874
Total Cash Contributions	**$145,731**	**$0**	**$0**	**$145,731**

In-Kind Contributions	2020/21	2021/22	2022/23	Total
CSIRO (25%)	$48,577	$0	$0	$48,577
Total In-Kind Contributions	**$48,577**	**$0**	**$0**	**$48,577**

	Total funding over all years	Percentage of Total Budget
Federal Government Investment	$132,829	68.36%
NT Government Investment	$7,053	3.63%
Origin Energy	$2,487	1.28%
Santos	$2,487	1.28%
Pangaea Resources	$874	0.45%
CSIRO Investment	$48,577	25%
TOTAL	**$194,308**	**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	Produce baseline and indicators	GISERA	Jul-20	Aug-20	2020/21	$20,049
Task 2	2.1	Mapping of logistical processes and supply chains for construction and operational phases of shale and gas industry in Beetaloo Basin	GISERA	Aug-20	Oct-20	2020/21	$29,019
Task 3	3.1	Transport impacts of shale and gas industry in Beetaloo Basin	GISERA	Nov-20	Jan-20	2020/21	$27,726
Task 4	4.1	Validation of results and identification of interventions	GISERA	Jan-21	Feb-21	2020/21	$21,221
Task 5	5.1	Intervention options and report	GISERA	Mar-21	Jun-21	2020/21	$47,717

12. References

Austroads (2016). Identification of a Risk Indicator to Support 'Life Line' Freight Routes. Research Repot AP-R525-16.

Higgins AJ, McFallan S, McKeown A, Bruce C, Marinoni O, Chilcott C, Stone P, Laredo L, Beaty M (2017). TraNSIT: Unlocking options for efficient logistics infrastructure in Australian agriculture. CSIRO, Australia. www.csiro.au\TraNSIT

Higgins AJ, McFallan S, Laredo L, Prestwidge D. (2015). Cost of transport infrastructure and regulatory constraints in Australian cattle supply chains. CSIRO report for Meat and Livestock Association. MLA Project NO G.POL.1405

Higgins A, McFallan S, Marinoni O, McKeown A, Chilcott C, Pinkard L. (2018). Informing transport infrastructure investments using TraNSIT: A case study for Australian agriculture and forestry. Computers and Electronics in Agriculture, 154, 187-203.

Higgins A, McFallan S, Bruce C, McKeown A, Chilcott C. (2018). Informing major government programs for rural transport infrastructure in northern Australia. The Rangeland Journal, 40, 341-351.

IQ-RAP (2016). Inland Queensland Roads Action Plan. Regional Development Australia Townsville and North West Queensland. www.rdanwq.org.au

Department of Environment and Heritage Protection (2013) Gas Field Development Project EIS, Chapter 4 Project Description and Appendix M, https://www.qld.gov.au/__data/assets/pdf_file/0024/108429/surat-gas-project-eis-assessment-report.pdf

2 Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority provided by the GISERA National Research Management Committee, in accordance with the National GISERA Alliance Agreement.

The table below details variations to research Project Order.

Register of changes to Research Project Order

Date	Issue	Action	Authorisation

3 Progress against project milestones

Progress against milestones are approved by the GISERA Director, acting with authority provided by the GISERA National Research Management Committee, in accordance with the National GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: Traffic Light Reports and descriptive Project Schedule Reports.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:
   - **Green**:
     - Milestone fully met according to schedule.
     - Project is expected to continue to deliver according to plan.
     - Milestone payment is approved.
   - **Amber**:
     - Milestone largely met according to schedule.
     - Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
     - Milestone payment approved for one amber light.
     - Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.
   - **Red**:
     - Milestone not met according to schedule.
     - Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
     - Milestone payment is withheld.
     - Project review initiated and undertaken by GISERA Regional Research Advisory Committee.
2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

Project Schedule Table

ID	Activities / Task Title (should match activities in impact pathway section)	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
Task 1	Produce baseline and indicators	Stephen McFallan	1 July 2020	30th August 2020	nil
Task 2	Mapping of logistical processes and supply chains for construction and operational phases of shale and gas industry in Beetaloo Basin	Andrew Higgins	1 August 2020	31st October 2020	1
Task 3	Transport impacts of shale and gas in Beetaloo Basin, including additional indicators	Stephen McFallan	1st November 2020	31st January 2021	2
Task 4	Validation of results and identification of interventions	Andrew Higgins	31st January 2021	28 February 2021	2
Task 5	Modelling of intervention options and submission of final report	Stephen McFallan	1st March 2021	30th June 2021	4

A request for an "accelerated analysis" by key stakeholders may require some outputs of these tasks to be moved forward. After the completion of Tasks 1 and 2, some analysis for Tasks 3 to 5 can be brought forward if there is a need for early results. For example, in Task 5, an intervention option can be analyzed before March 2021, if the intervention option has been defined by stakeholders earlier on.

Project Schedule Report

Task description

Task 1

TASK NAME: Produce baseline and produce indicators

TASK LEADER: Stephen McFallan

OVERALL TIMEFRAME: 1 July 2020 to 30 August 2020

BACKGROUND: To understand the transport related impacts for shale and gas in the NT Beetaloo Basin, a "pre" baseline needs to be produced showing what is the current freight across the road and rail network.

TASK OBJECTIVES: To produce a baseline of freight and personnel transport in the Beetaloo Basin, for comparison with 'peak' construction and production scenarios.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Baseline of current freight movements across the NT road/rail network, including critical link analysis of supply chains into other states/territories. The baseline analysis will consist of a range of road and rail freight maps for NT, along with transport economics of each commodity class. The freight maps will show the number of vehicles and rail wagons along each segment of the network, including direction, vehicle type, supply chain leg, etc. This will provide stakeholders with a common understanding of what is currently moving around the NT road and rail networks. TraNSIT already contains the freight movements by commodity for all trips in, out and through the NT. By consulting with industry and government, other key transport-related indicators (e.g. road damage, dust, connectivity for other road users and communities, sensitive freight paths) will be identified and methods for including in TraNSIT.

PROGRESS REPORT:

This milestone is 80% complete.

A draft baseline of current freight movements (road/rail) across the GISERA study area (Beetaloo sub-basin) was produced for all commodities combined, and for key ones (e.g. Cattle, minerals, fuel) separately. Corresponding economics data was also produced. The map and economics outputs were reviewed by the TraNSIT team and some errors in placement of some key enterprises in the broader region were identified and fixed. The baseline has been re-run based on the updated data and maps have been created.

Maps will be emailed sent next week to the TRG members, asking for their feedback. We will hold follow up discussions to confirm their feedback (which will be incorporated in the final baseline) and to elicit information required for Task 2.

The team have obtained ethics permission from CSSHREC for this project.