Mapping future transport for improved planning and operation

GISERA Project S.16

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Presentation overview

- Project aim
- Project phases
- TraNSIT – overview and previous applications
- Project findings
  - Baseline (current)
  - Reference baselines (construction, operation)
  - Scenarios
- Implications and conclusions

Northern Territory sunrise. Photo: Geoff Whalan

Project aim

- Aim: to map out key impacts of road and rail network development for gas wells before onshore gas construction occurs in the Beetaloo Sub-basin
  - The Scientific Inquiry into Hydraulic Fracturing in the NT recommends that: ‘the Government assesses the impact 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’.
- Impacts:
  - changes in traffic flows due to heavy freight
  - construction and operational phases
  - transport options through scenarios
- Outputs: information for decision-makers to help inform road upgrades, potential damage, road safety, etc


GISERA

AUGUST 2020
SOCIAL AND ECONOMIC FACTSHEET

Mapping future transport for improved planning and operation

This project aims to map out key impacts of road and rail network development for gas wells before onshore gas construction occurs in the Beetaloo Sub-basin, Northern Territory.

The challenge

Construction phases of onshore gas projects can impact regional road networks through increases in the type and number of vehicles along many roads. This can result in road damage, and increased noise and dust.

The Scientific Inquiry into Hydraulic Fracturing in the Northern Territory found there has so far been no formal analysis of the impacts of transport, nor the use of road and rail networks to deliver supplies to gas regions that may reduce road freight requirements.

The inquiry's final report recommends that 'the Government assesses the impact 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'.

KEY POINTS

- Construction of onshore gas wells can impact regional road networks.
- The Scientific Inquiry into Hydraulic Fracturing in the NT has recommended an assessment of impacts and the use of existing rail networks for the reduction of impacts on roads.
- Information from the project covers traffic forecasts, and feasibility of rail or road investments.
- Outputs will include detail in easy to interpret formats such as maps and tables for each affected location.

The Beetaloo Sub-basin

The Beetaloo Sub-basin lies south-east of Katherine, spanning an area of almost 30,000 square kilometres. One of the most prospective areas for shale gas in Australia, it contains an estimated prospective resource of 178,200 petajoules (PJ) of gas.

This project will provide a pre-construction analysis of freight costs, flows and impacts for identified gas development sites in the Northern Territory's Beetaloo Sub-basin.

Objectives of this project

The project will provide freight, economic and environmental information to government, communities and industry on the impacts of heavy vehicle transport on roads and communities for the life of the proposed development.

This study will provide transport options for reduced over generation that may benefit communities and surrounding vegetation.

What is the project timeline?

July 2020 – July 2021

When will the results be available?

Final reporting, with intervention options, is expected in June 2021. All results will be published on the GISERA website.

Who is funding this project?

The project is co-funded by the Australian Government, the NT Government, CSIRO, Origin Energy, Santos and Pangaea Resources.

Project phases

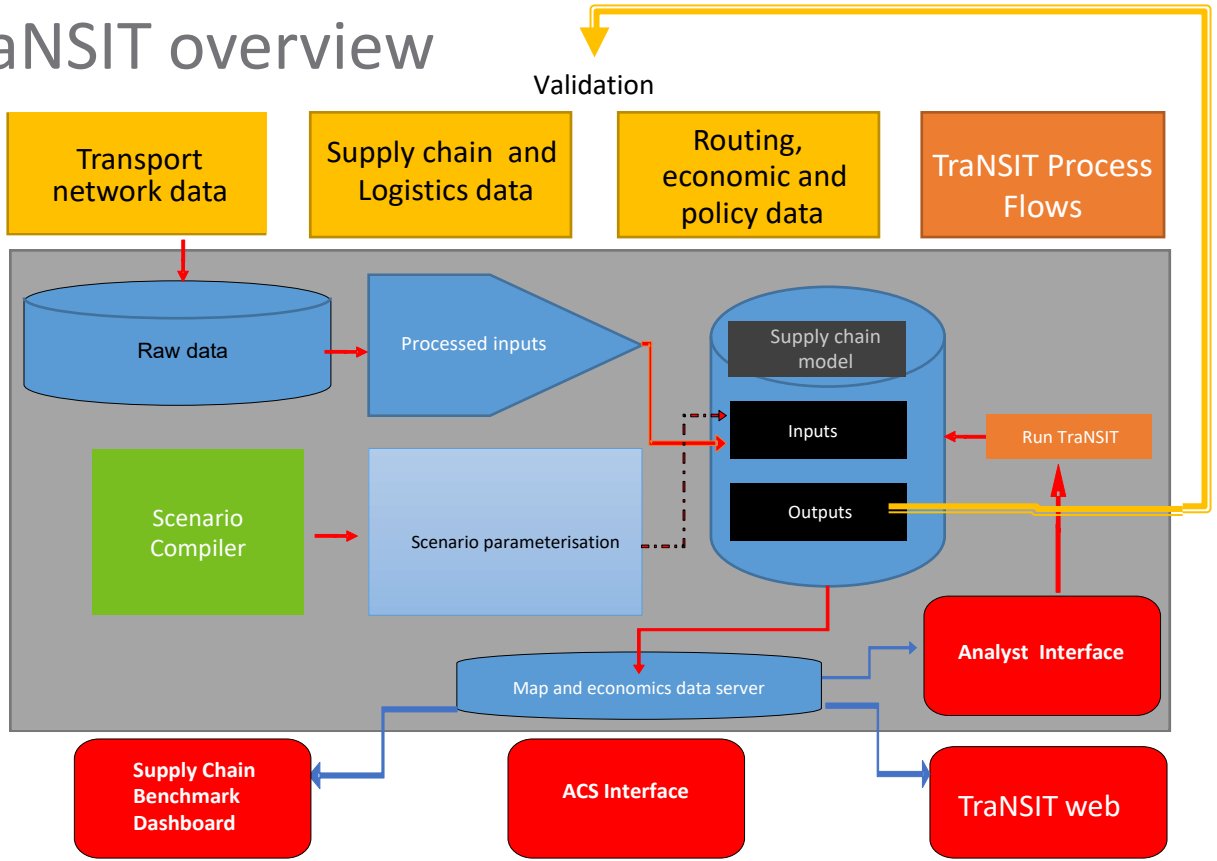
1. Apply the Transport Network Strategic Investment Tool (TraNSIT) to produce a baseline map of freight volumes across road and rail networks.
2. Through a series of workshops and interviews, capture data on logistics, construction phase inputs and sources, freight task and supply chains throughout the proposed development.
3. Model projected heavy vehicle movements across NT road networks based on the data from point 2 above.
4. Validate modelling outputs and identify interventions that may reduce impacts.
5. Use TraNSIT to test a range of intervention options identified by stakeholders.

TraNSIT overview

- What is TraNSIT?
  - Computer-based tool that maps freight routes from origin to destination
  - Calculates transport route, **costs** (by mode) and vehicle choice

- What questions does TraNSIT inform?
  - **What** are the transport cost savings (per year) from infrastructure investment and regulatory changes?
  - **Where** should investment be targeted across a range of options?
  - **Which** enterprises and supply chains are impacted, and how?

TraNSIT overview



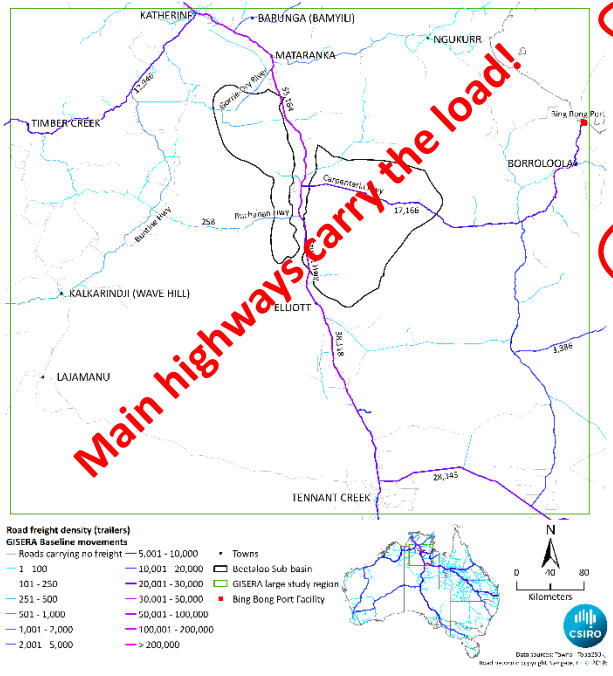
Applications of TraNSIT

- Commonwealth Government
  - Inland Rail
  - Roads of Strategic Importance
  - Beef Roads
- State government
  - Cattle tick line
  - Prioritising bridge investments
  - High productivity vehicle access around and through towns
- Local government and ROCs
  - Most extensive applications – over 30 local governments
  - Regional freight planning
  - Various road upgrades
  - Intermodal and processing facilities
- Industry
  - Supply chain mapping to ports and last mile upgrades
  - Rail network planning and intermodal upgrades
- International
  - Indonesia, Vietnam, Solomon Islands and NE Africa

Project findings

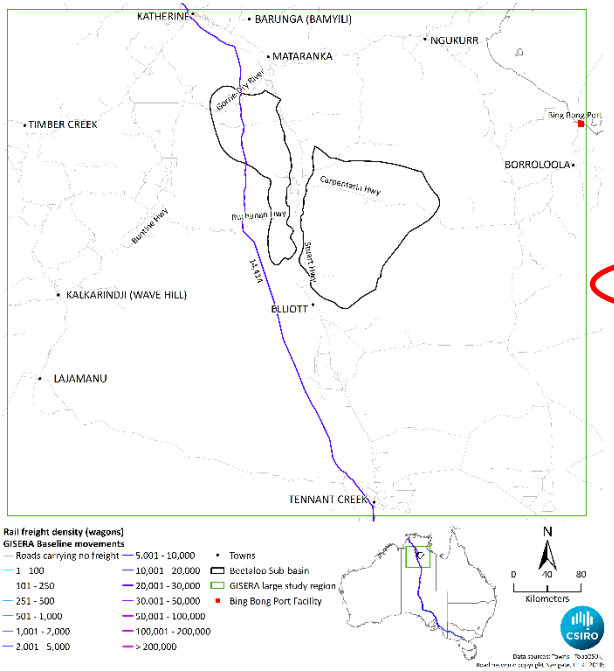
- Baseline (current)
- Reference baselines (construction, operation)
- Scenarios

Project findings: baseline road



COMMODITY	TOTAL COST ($)	TONNES	COST PER TONNE ($/T)	TRANSPORT DISTANCE (KM)	ONE WAY TRAVEL TIME (HRS)	TRAILERS
Cropping	$28,852,834	62,380	$462.53	4,257	42.1	2,933
Fuel	$52,425,576	737,769	$71.06	727	7.8	29,755
General	$96,758,816	202,485	$477.86	3,078	30.7	12,058
Horticulture	$52,671,285	86,945	$605.80	3,466	36.5	4,922
Livestock	$48,823,879	349,850	$139.56	1,012	13.4	18,229
Mining	$35,709,281	779,000	$45.84	475	5.7	28,881
Processed Food	$33,612,584	38,902	$864.03	3,657	38.4	2,940
Vehicles	$45,821,840	24,758	$1,850.76	3,655	37.7	4,126
Waste	$211,123	13,176	$16.02	22	0.4	1,318
Wood Product	$29,095,893	57,641	$504.77	3,815	42.0	3,124
Grand Total	$423,983,109	2,352,908	$180.20	1,234	13.5	108,286

Project findings: baseline rail



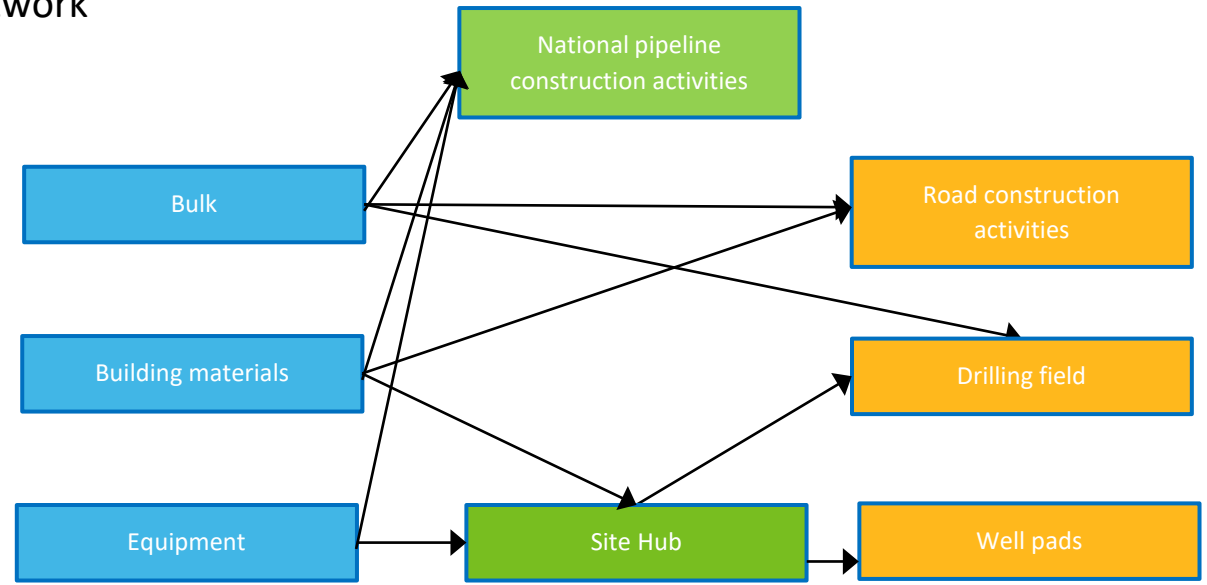
COMMODITY	TOTAL COST ($)	TONNES	COST PER TONNE ($/T)	TRANSPORT DISTANCE (KM)	ONE WAY TRAVEL TIME (HRS)	WAGONS
General	$4,026,998	14,534	$277.07	3,254	47.1	1,020
Horticulture	$1,054,232	5,063	$208.22	3,304	48.1	251
Mining	$12,907,053	104,583	$123.41	2,121	28.6	2,229
Processed Food	$217,286	1,137	$191.16	3,029	42.9	56
Vehicles	$2,336,408	2,429	$961.86	3,520	52.2	607
Wood Product	$2,602,150	11,518	$225.92	3,239	46.8	642
Grand Total	$23,144,126	139,264	$166.19	2,407	33.3	4,805

Project findings

- Baseline (current)
- Reference baselines (construction, operation)
  - Additional dust generation
  - Critical link analyses
- Scenarios

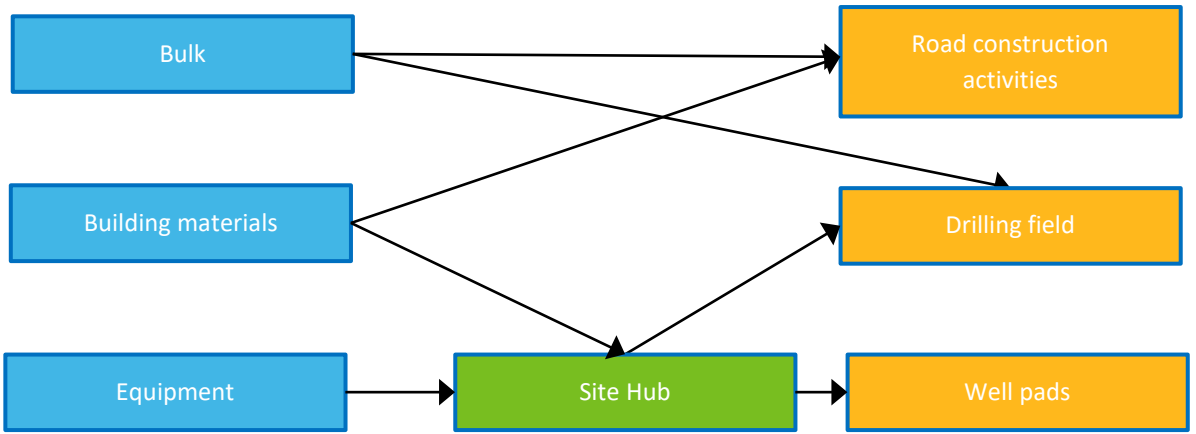
Supply chain map – construction yr 1 (incl. pipes)

Construction of gas field infrastructure and extension/duplication of national pipeline network



Supply chain map – construction yr 2

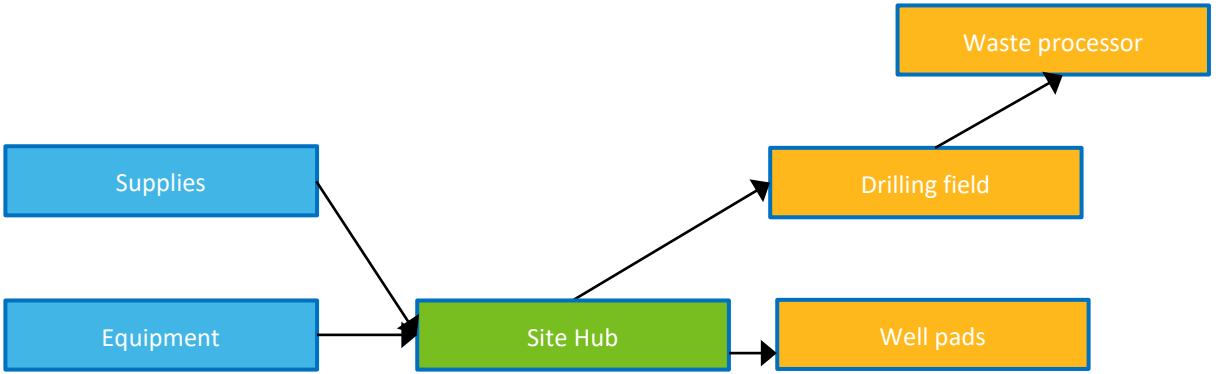
Construction of gas field infrastructure



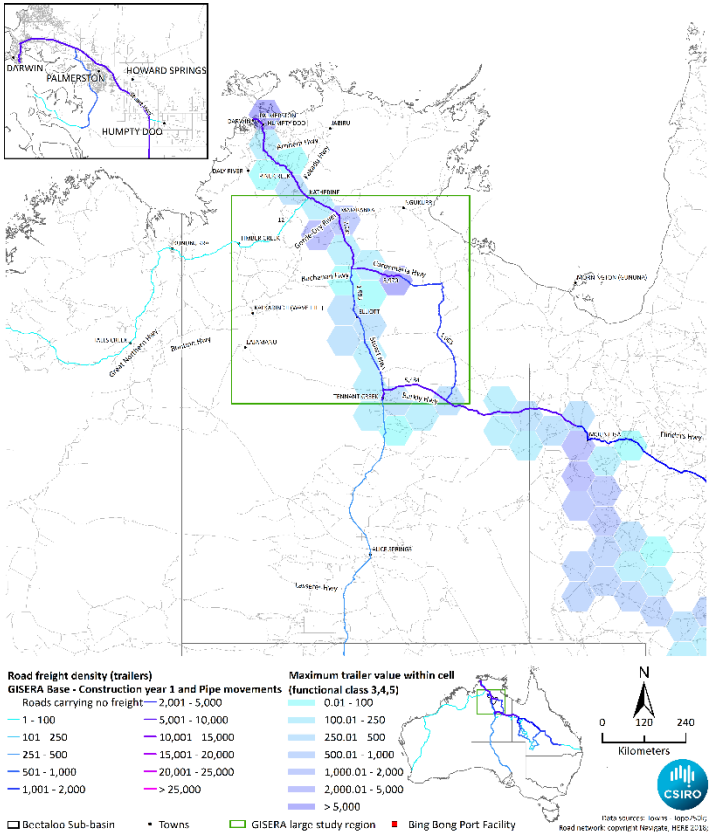
Supply chain map – peak* operation, operation

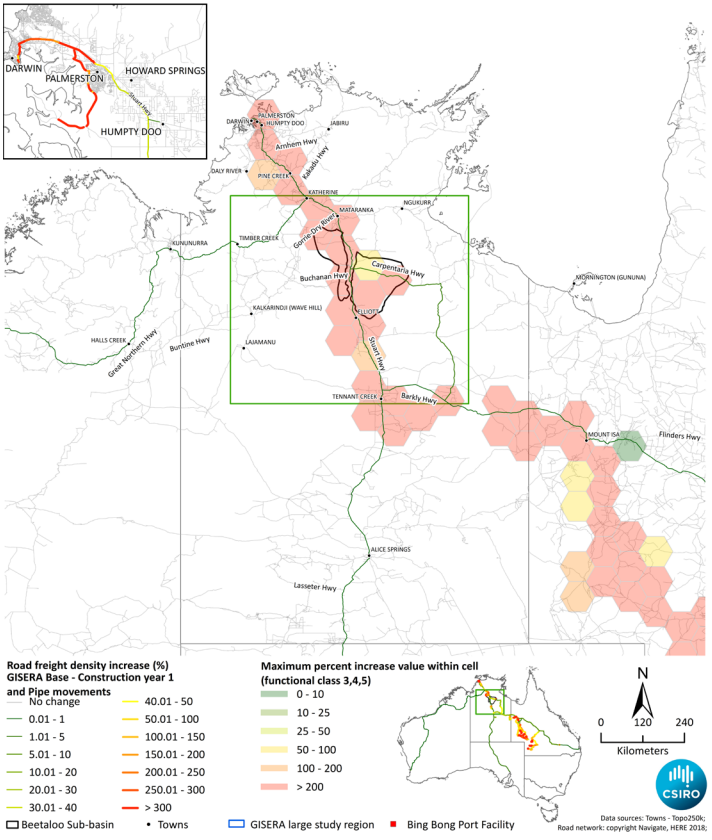
Well operation, maintenance, waste extraction

* Peak operation occurs about yr6 of operation

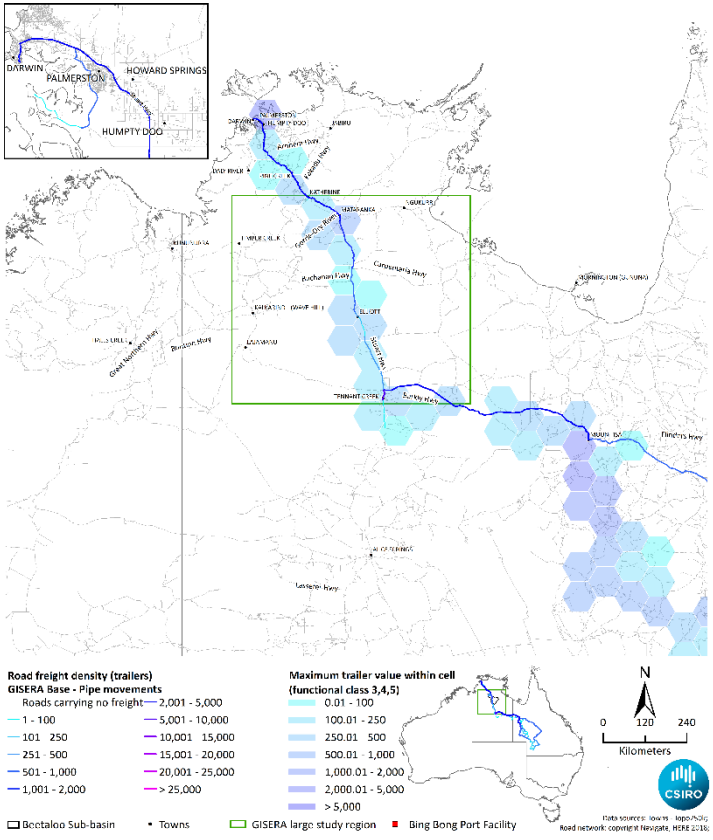


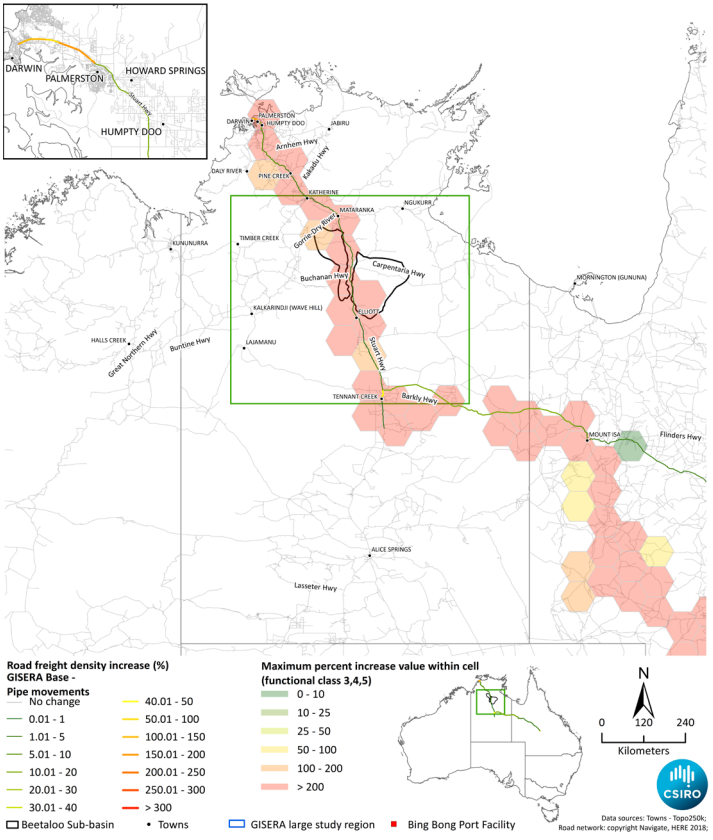
Construction yr 1 & pipelines





Pipelines


DARWIN
PALMERSTON
HOWARD SPRINGS
HUMPTY DOO
Road freight density (trailers)
GISERA Base - Pipe movements
Roads carrying no freight
1 - 100
101 - 250
251 - 500
501 - 1,000
1,001 - 2,000
2,001 - 5,000
5,001 - 10,000
10,001 - 15,000
15,001 - 20,000
20,001 - 25,000
> 25,000
Maximum trailer value within cell
(functional class 3,4,5)
0.01 - 100
100.01 - 250
250.01 - 500
500.01 - 1,000
1,000.01 - 2,000
2,000.01 - 5,000
> 5,000
N
0
120
240
Kilometers
Beetaloo Sub-basin
Towns
GISERA large study region
Bing Bong Port Facility
Data sources: Towns - Topo250k;
Road network: copyright Navigate, HERE 2018;


DARWIN
PALMERSTON
HOWARD SPRINGS
HUMPTY DOO
Road freight density increase (%)
GISERA Base -
Pipe movements
No change
0.01 - 1
1.01 - 5
5.01 - 10
10.01 - 20
20.01 - 30
30.01 - 40
40.01 - 50
50.01 - 100
100.01 - 150
150.01 - 200
200.01 - 250
250.01 - 300
> 300
Maximum percent increase value within cell
(functional class 3,4,5)
0 - 10
10 - 25
25 - 50
50 - 100
100 - 200
> 200
N
0
120
240
Kilometers
Beetaloo Sub-basin
Towns
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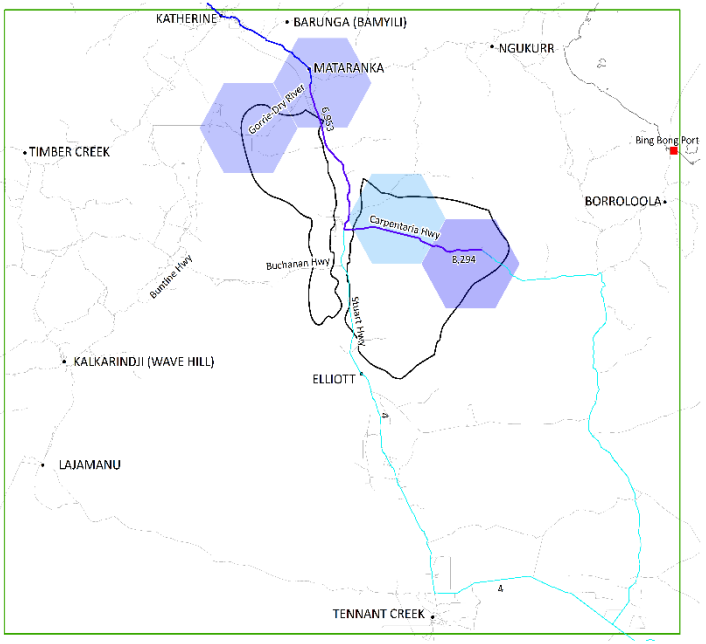
Data sources: Towns - Topo250k;
Road network: copyright Navigate, HERE 2018;

Construction yr 2



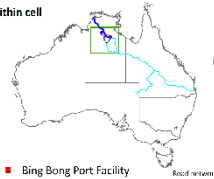
Road freight density (trailers)
GISERA Base - Construction year 2 movements

- Roads carrying no freight
- 1 - 100
- 101 - 250
- 251 - 500
- 501 - 1,000
- 1,001 - 2,000
- 2,001 - 5,000
- 5,001 - 10,000
- 10,001 - 15,000
- 15,001 - 20,000
- 20,001 - 25,000
- > 25,000

Maximum trailer value within cell (functional class 3,4,5)

- 0.01 - 100
- 100.01 - 250
- 250.01 - 500
- 500.01 - 1,000
- 1,000.01 - 2,000
- 2,000.01 - 5,000
- > 5,000

Beetaloo Sub-basin • Towns GISERA large study region ■ Bing Bong Port Facility



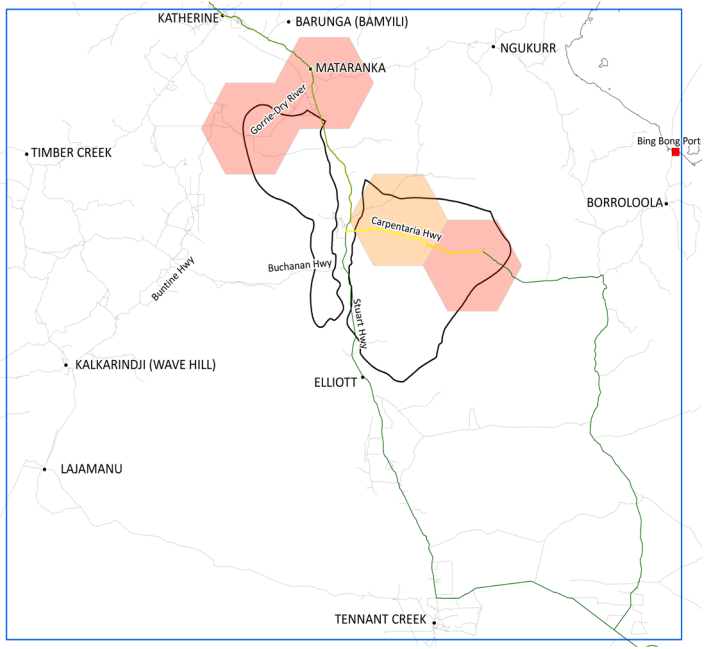
N

0 40 80

Kilometers

CSIRO

Data sources: Towns - Topo250c
Road network: copyright Navigate, HERE 2018;



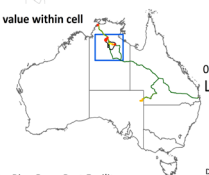
Road freight density (trailers)
GISERA Base - Construction year 2 movements

- No change
- 0.01 - 1
- 1.01 - 5
- 5.01 - 10
- 10.01 - 20
- 20.01 - 30
- 30.01 - 40
- 40.01 - 50
- 50.01 - 100
- 100.01 - 150
- 150.01 - 200
- 200.01 - 250
- 250.01 - 300
- > 300

Maximum percent increase value within cell (functional class 3,4,5)

- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- > 200

Beetaloo Sub-basin • Towns GISERA large study region ■ Bing Bong Port Facility



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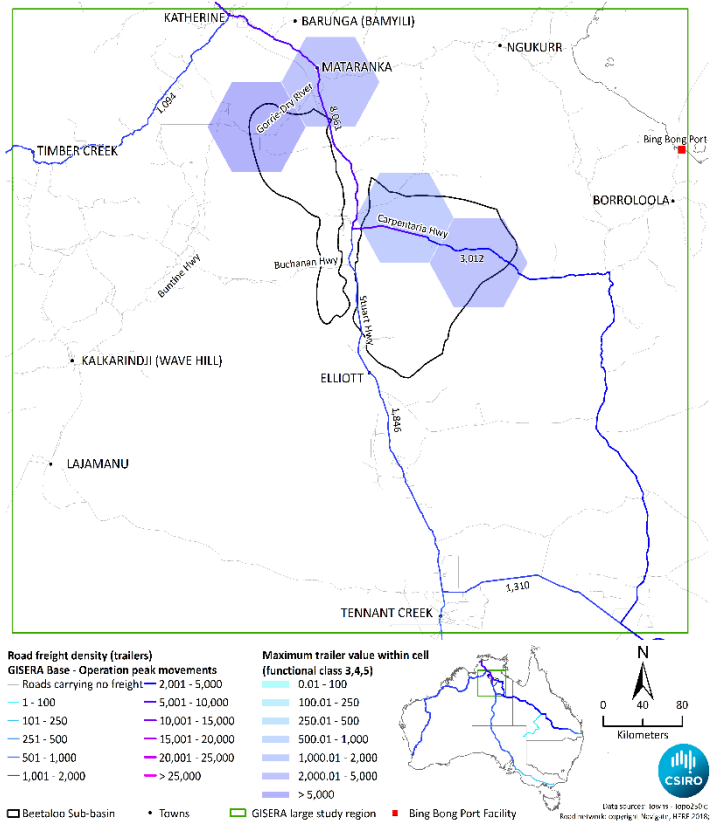
0 40 80

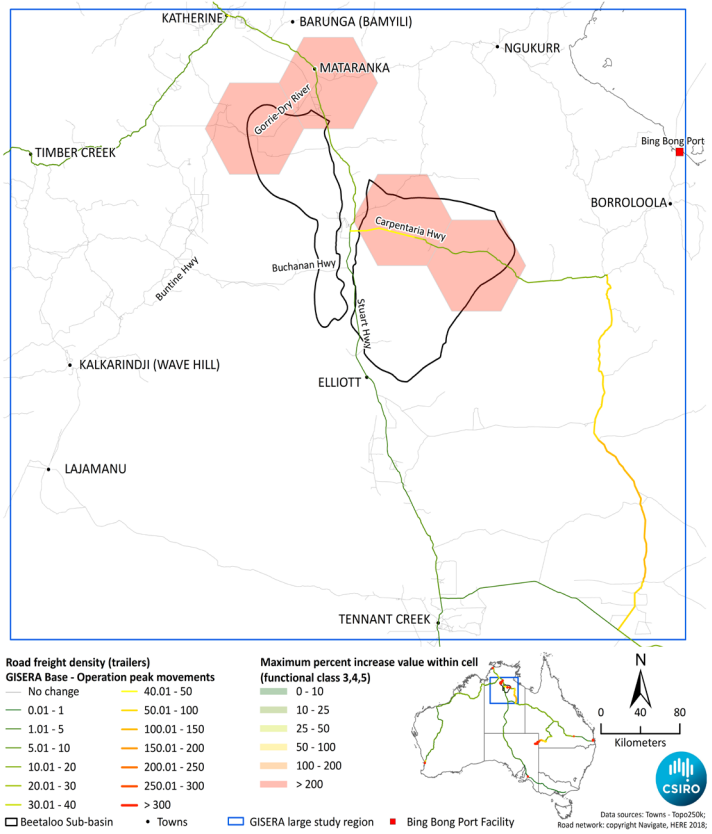
Kilometers

CSIRO

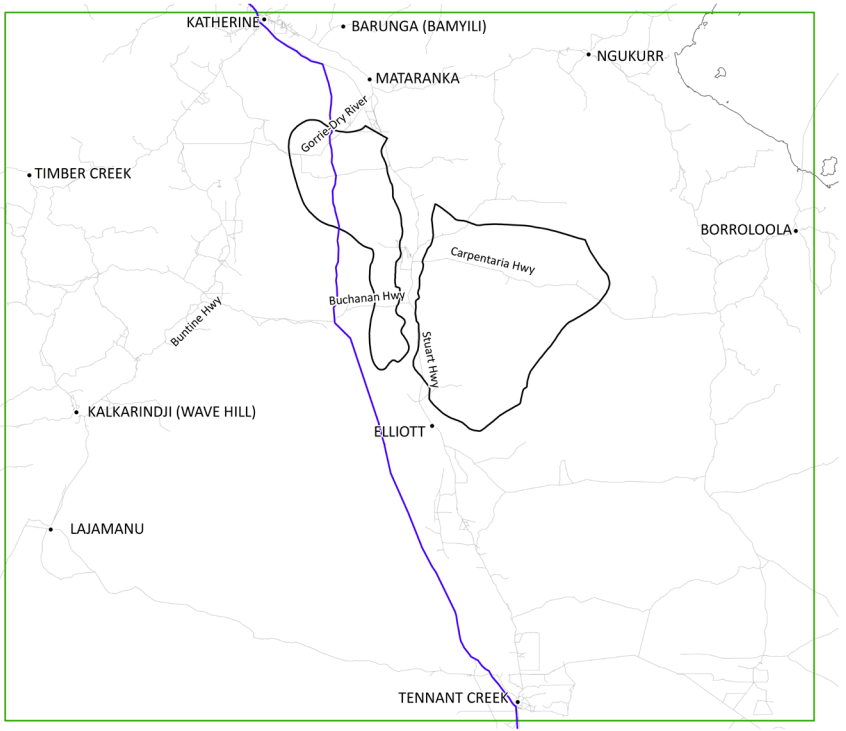
Data sources: Towns - Topo250c;
Road network: copyright Navigate, HERE 2018;

Peak operation





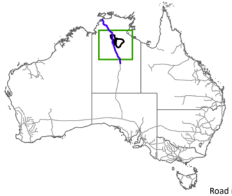
Rail, construction year 1



Rail freight density (wagons)
GISERA Base - Rail movements

- 1 - 100
- 101 - 250
- 251 - 500
- 501 - 1,000
- 1,001 - 2,000
- 2,001 - 5,000
- 5,001 - 10,000
- 10,001 - 20,000
- 20,001 - 30,000
- 30,001 - 50,000
- 50,001 - 100,000
- 100,001 - 200,000
- > 200,000

- Beetaloo Sub-basin
- Towns
- GISERA large study region
- Roads



N

0 40 80

Kilometers

Data sources: Towns - Topo250k;
Road network: copyright Navigate, HERE 2018;

Construction yr 1 & pipelines

COMMODITY	TOTAL COST ($)	TONNES	COST PER TONNE ($/T)	TRANSPORT DISTANCE (KM)	ONE WAY TRAVEL TIME (HRS)	TRAILERS
Ambulance	$20,625	375	$55.00	527	7.0	15
Camp	$124,109	4,250	$29.20	264	3.9	170
Drilling pipes	$1,949,256	11,850	$164.49	1,787	20.1	474
Fuel & storge tanks	$468,980	11,700	$40.08	377	5.4	468
Pipes	$27,699,441	377625	75.61	1,707	11.2	16,350
Pond equipment	$8,898,912	51,375	$173.21	1,892	21.2	2,055
Processing facility equipment	$8,554,081	127,500	$67.09	732	7.7	5,100
Rig equipment	$265,150	23,500	$11.28	80	1.2	940
Grand Total	$47,980,554	608,175	$78.03	1420	10.9	25,572

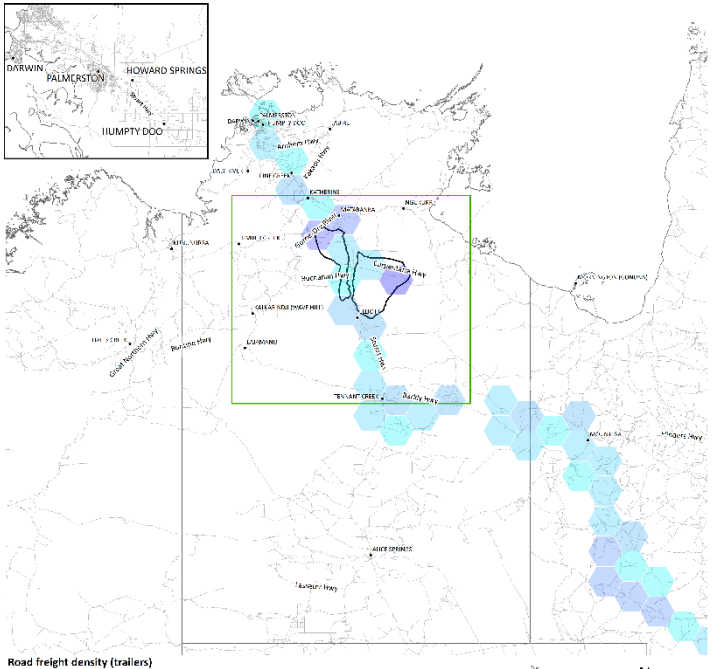
Construction yr 2

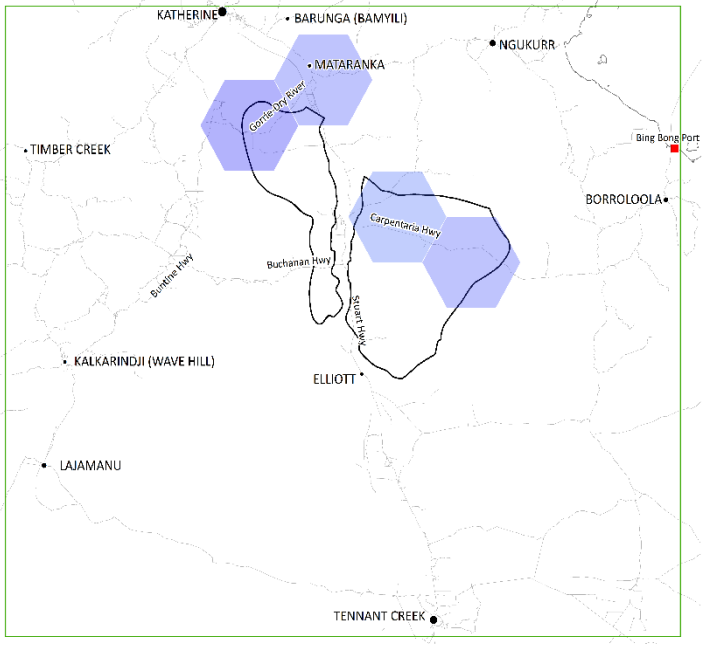
COMMODITY	TOTAL COST ($)	TONNES	COST PER TONNE ($/T)	TRANSPORT DISTANCE (KM)	ONE WAY TRAVEL TIME (HRS)	TRAILERS
Pipes Road Leg	$17,461,957	253,125	$68.99	663	8.4	10,125
Pipes Rail Leg	$10,237,484	124,500	$82.23	1,044	14.0	6,225
Grand Total	$27,699,441	377625	75.61	1,707	11.2	16,350

Peak operation

COMMODITY	TOTAL COST ($)	TONNES	COST PER TONNE ($/T)	TRANSPORT DISTANCE (KM)	ONE WAY TRAVEL TIME (HRS)	TRAILERS
Casing, tubing, pup joints	$3,858,021	93,250	$41.37	425	5.1	3,730
Core samples	$1,087,693	5,625	$193.37	2,017	22.8	225
Crane lifts	$67,101	9,150	$7.33	39	0.8	366
Drilling accessories	$121,066	12,250	$9.88	71	1.0	490
Drilling containers	$2,104,928	13,500	$155.92	1,548	21.6	540
Fishing equipment	$3,579,432	19,575	$182.86	2,002	22.0	783
Float equipment	$595,754	13,325	$44.71	463	5.0	533
Fuel - diesel	$4,046,467	34,500	$117.29	1,219	14.8	1,380
Geological equipment	$1,008,555	9,375	$107.58	1,158	12.8	375
Medical supplies	$32,110	950	$33.80	325	3.9	38
Muds	$8,372,071	165,475	$50.59	501	6.8	6,619
Pup joints	$1,832,916	5,800	$316.02	2,985	32.1	232
Specialised equipment	$8,915,030	33,600	$265.33	2,849	30.0	1,344
Stimulation equipment	$10,440,018	48,725	$214.26	2,362	26.2	1,949
Water samples	$1,299,796	3,850	$337.61	3,616	38.8	154
Wellhead equipment	$1,987,880	13,950	$142.50	1,518	16.3	558
Grand Total	$49,348,837	482,900	$102.19	1,072	12.4	19,316

Dust – construction yr 1, peak operation





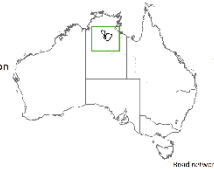
Road freight density (trailers)
GISERA Base dust impact - Construction year 1 and Pipe movements
Maximum trailer value within cell
(functional class 3,4,5)

- 0.01 - 100
- 100.01 - 250
- 250.01 - 500
- 500.01 - 1,000
- 1,000.01 - 2,000
- 2,000.01 - 5,000
- > 5,000

- Beetaloo Sub-basin
- Towns
- GISERA large study region
- Bing Bong Port Facility

Town population

- 0 - 500
- 501 - 1,000
- 1,001 - 2,500
- 2,501 - 5,000
- >5,000



N

0 120 240

Kilometers

Data sources: Towns - Topo250k;
Road network: copyright Navigate, HERE 2018

Road freight density (trailers)
GISERA Base dust impact - Operation peak movements
Maximum trailer value within cell
(functional class 3,4,5)

- 0.01 - 100
- 100.01 - 250
- 250.01 - 500
- 500.01 - 1,000
- 1,000.01 - 2,000
- 2,000.01 - 5,000
- > 5,000

- Beetaloo Sub-basin
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Town population

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- 1,001 - 2,500
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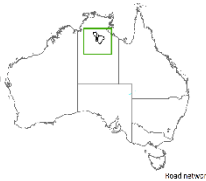


N

0 40 80

Kilometers

Data sources: Towns - Topo250k;
Road network: copyright Navigate, HERE 2018

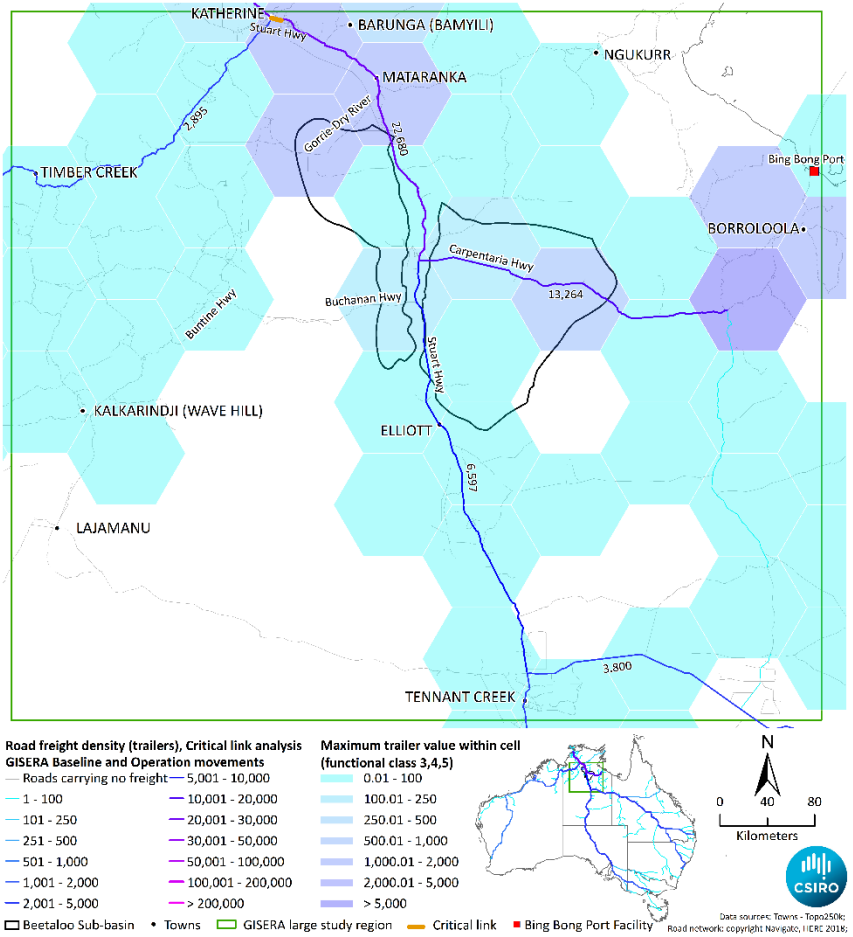
Critical link analysis

Number of trailers…

Road			Number of Trailers					Critical link analysis
	Road Ranking	Paved	National baseline	Construction yr1	Construction yr2	Operation	Peak operation	
Carpentaria Hwy	2	Y	16,507	5,566	6,949	3,413	7,177	Y
Gorrie-Dry River	4	N	678	787	2,274	1,792	3,573	Y
Stuart Hwy-Humpty Doo	1	Y	23,441	5,423	4,683	3,518	7,393	
Stuart Hwy-Katherine	1	Y	20,749	5,435	4,683	4,077	8,485	Y
Tiger Brennan Dr	3	Y	19,209	-	-	3,305	6,945	
Victoria Hwy	1	Y	13,931	12	-	547	1,094	

Also: number of freight paths, average travel distance

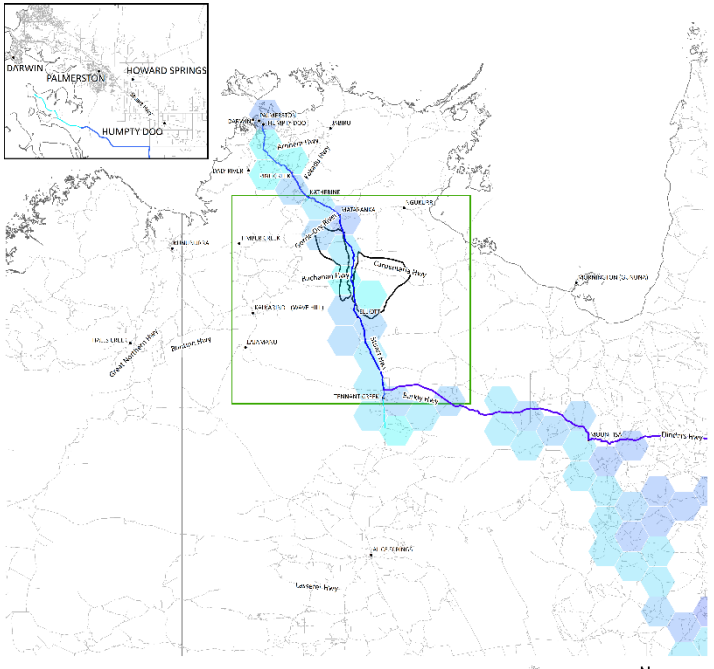
Critical link analysis

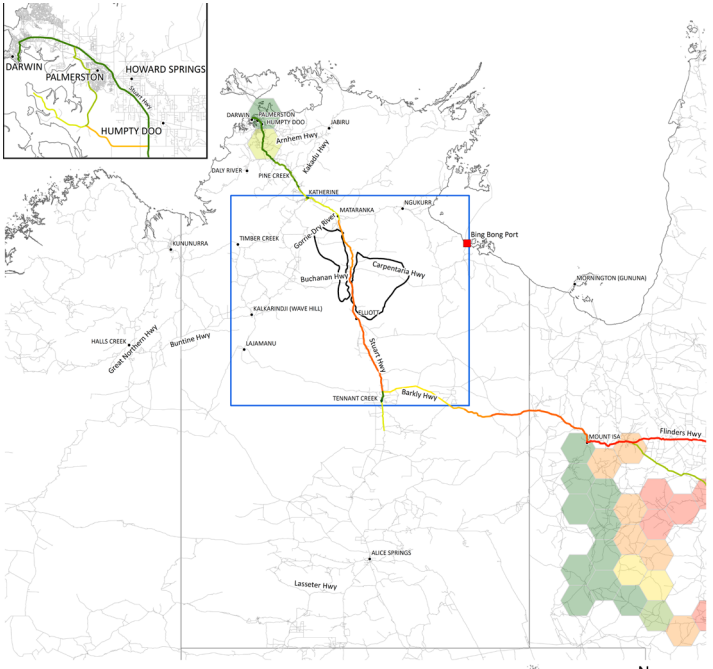


Project findings

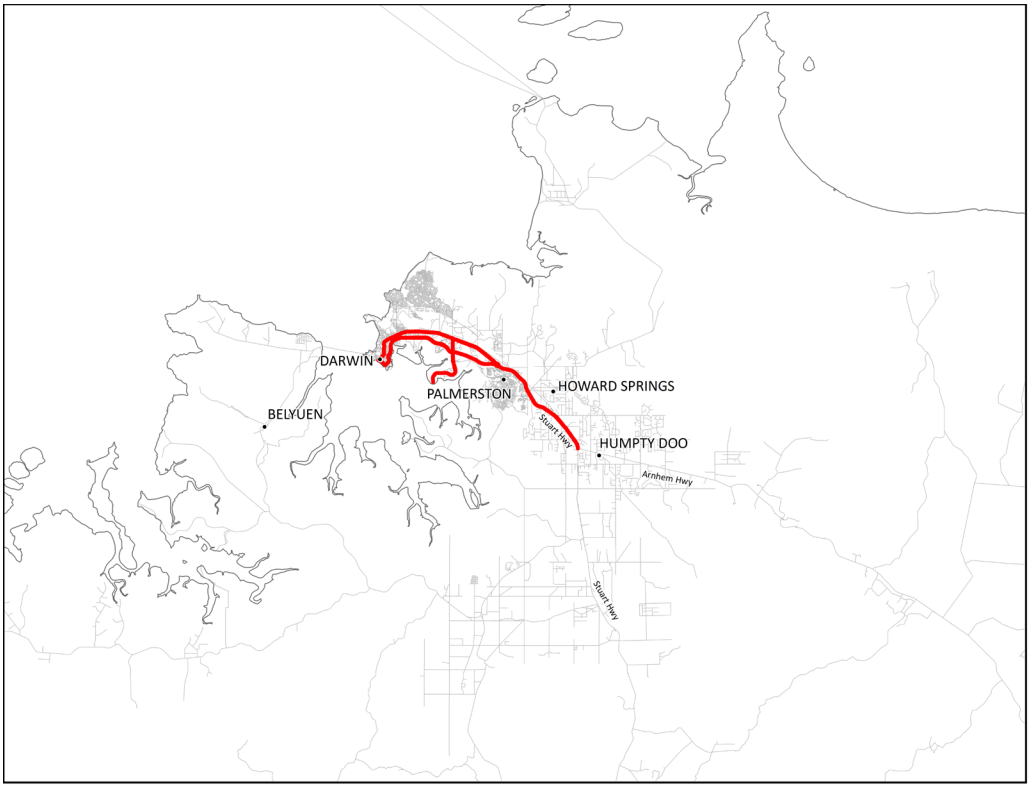
- Baseline (current)
- Reference baselines (construction, operation)
- Scenarios
  - Pipes from Townsville Port
  - Key roads congestion
  - Wet season road closures

Scenario 1 – Pipes from Townsville Port





Scenario 2 – Key roads congestion



Scenario 2 - Key roads congestion

- Towns
- Congested roads
- Roads

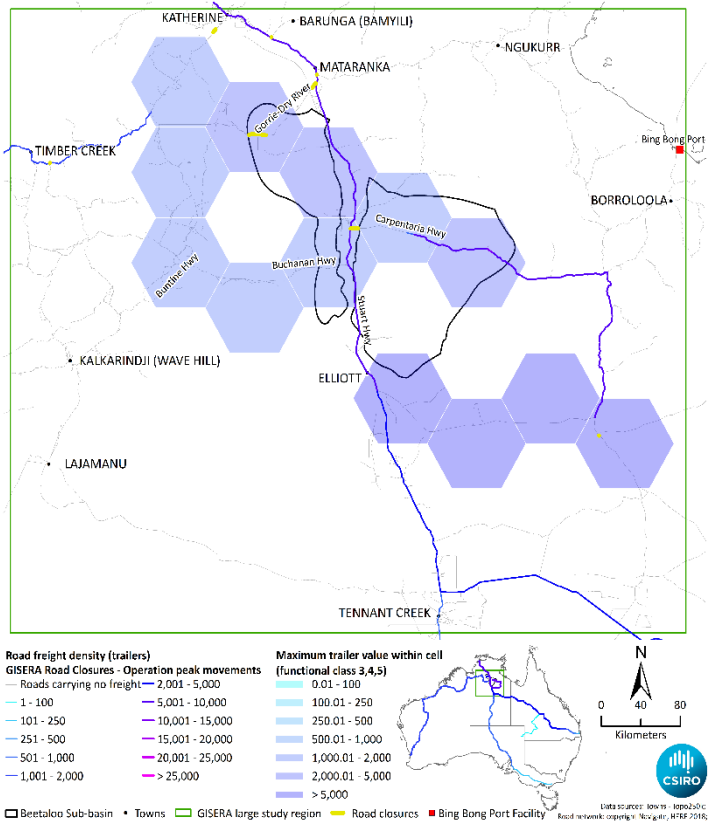
N

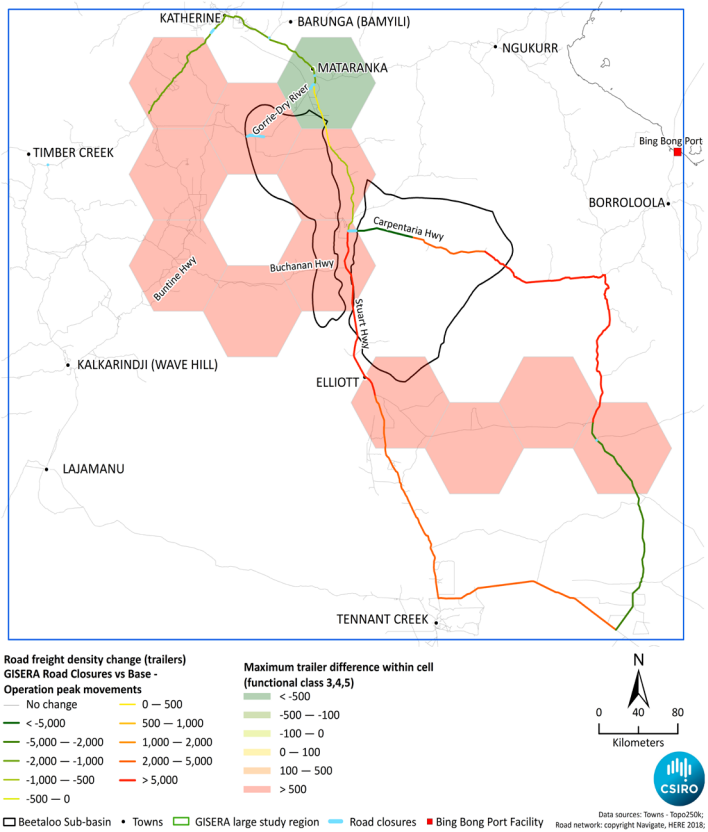
0 10 20

Kilometers

Data sources: Towns - Topo250k;
Road network: copyright Navigate, HERE 2018;

Scenario 3 – Wet season road closures





Implications and conclusions

- TraNSIT a valuable tool for modelling potential scenarios
  - Location, magnitude and cost of freight volume changes
- Good data is critical
- Ongoing improvements to TraNSIT model
- Evidence base to plan management interventions
  - Road damage
  - High usage areas
  - Dust -> environmental and community effects
  - Network upgrades and supply chain investments

Thank you

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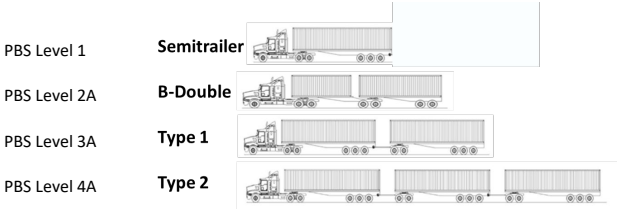
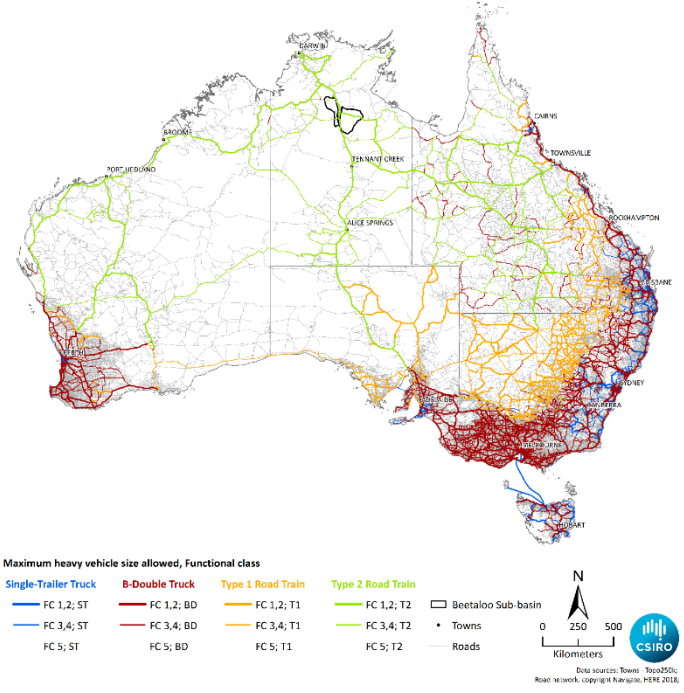
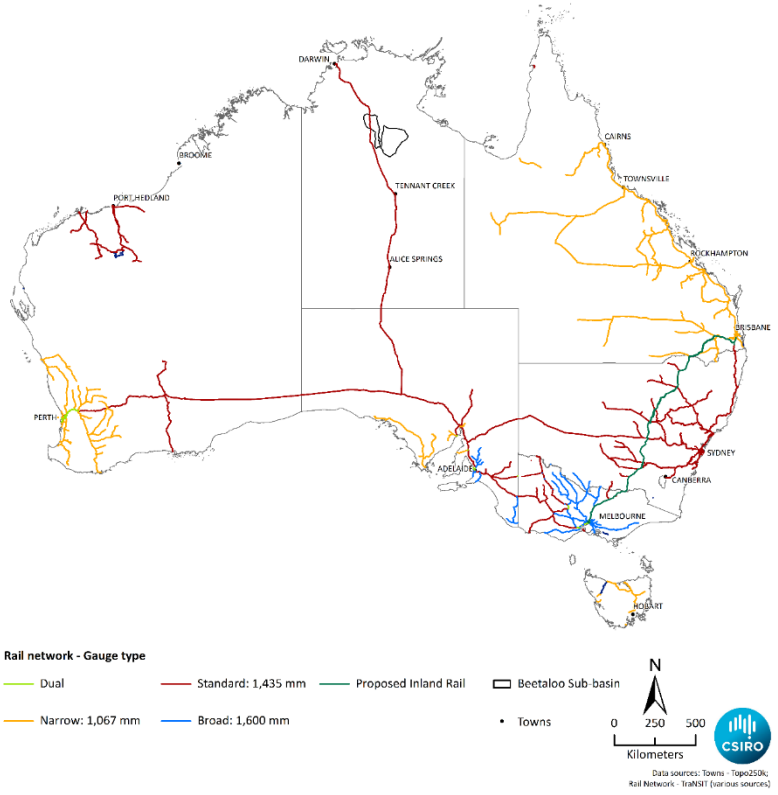
TraNSIT Road





- Vehicle operating cost model - variables
  - Vehicle type – 4 vehicle types
  - Fuel price
  - Fuel cost model
    - Incline, international roughness index, speed, tare and gross mass
  - Distance per segment, year
  - Travel time per segment, year
  - Tyres, maintenance costs
  - Driver costs
  - Fixed costs
  - Capital and depreciation

TraNSIT Rail



- Rail operating cost model - variables
  - 60+ train configurations
  - Distance
  - Track conditions – travel time, TAL etc
  - Rolling stock and train length
  - Wagon capacity and load efficiency
  - Track access charges
  - Backloading
  - Rolling stock maintenance
  - Fuel and crew costs
  - Capital costs
  - Overheads