SCIENTIFIC INQUIRY INTO
HYDRAULIC FRACTURING
IN THE NORTHERN TERRITORY

Interim Report

August 2017

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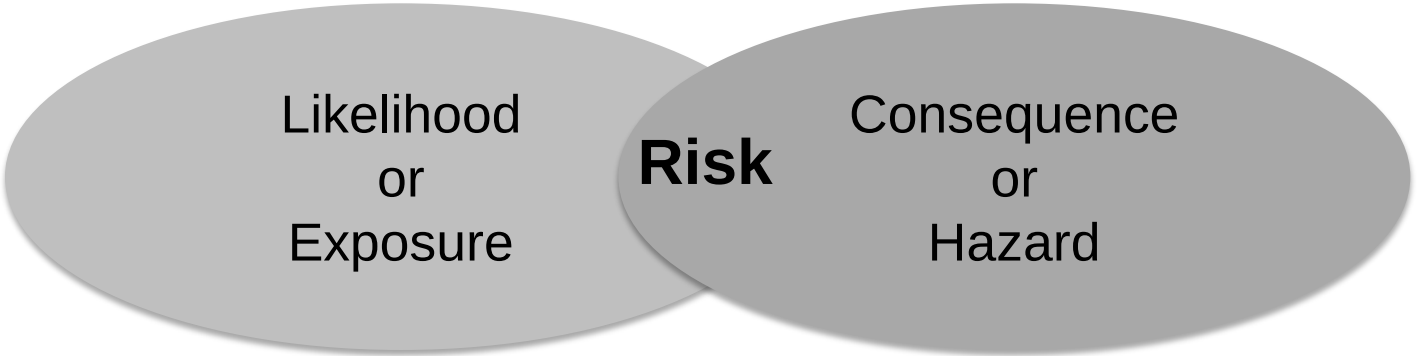
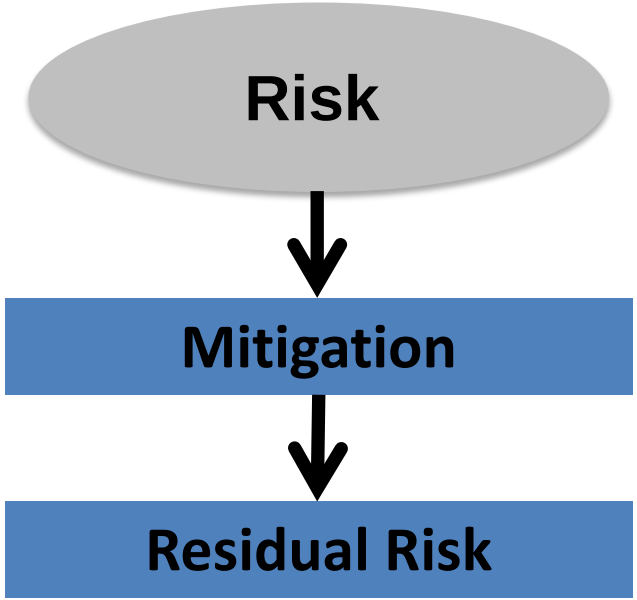
Risk assessment

Assessment of risk

- Risk = Likelihood (low, medium, high) x Consequences (low, medium, high)



Risk Assessment



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Shale gas development and management

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Typical stages of shale gas development

Several years

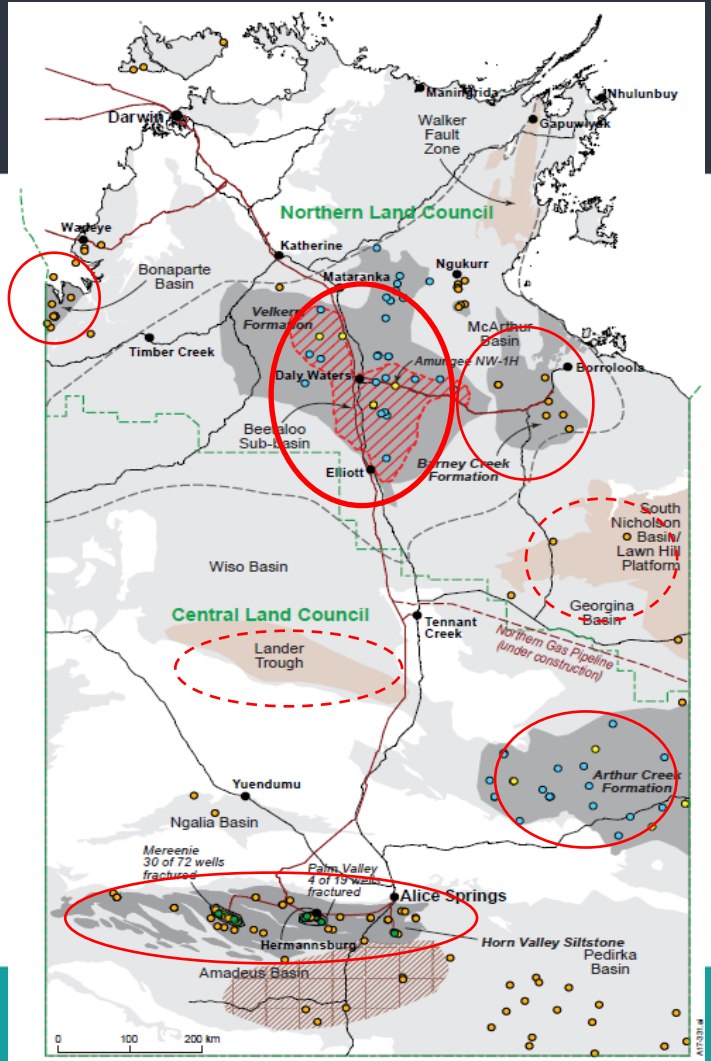
- Initial geological investigations, identification of the shale gas resource

~5 years

- Early evaluation drilling, seismic mapping
- Pilot drilling of horizontal wells

Several decades

- Pilot production testing
- Commercial development
- Decommissioning



Prospective shale gas areas

- Armadeus Basin
- Beetaloo Sub-basin
- McArthur Basin - Batten Fault zone
- Bonaparte Basin
- Georgina Basin
- Pedirka Basin
- Potential areas within South Nicholson Basin and Lander Trough

Possible development scenarios (if the moratorium is lifted by NTG)

- 1-2 shale gas resources practically able to be developed in the foreseeable future (5-10 years)
- Beetaloo Sub-basin most likely area for development
- scale of development is uncertain – estimates between 1,000 - 6,250 wells and 150 - 750 drilling pads
- estimated land area approximately 1300 km^2

Site and well management considerations

- Site infrastructure
- Well integrity
- Well decommissioning
- Water use
- Composition of hydraulic fracturing fluid
- Flowback and produced water volume and composition
- Management and reuse of flowback and produced water
- Solid water management

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Water

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Water

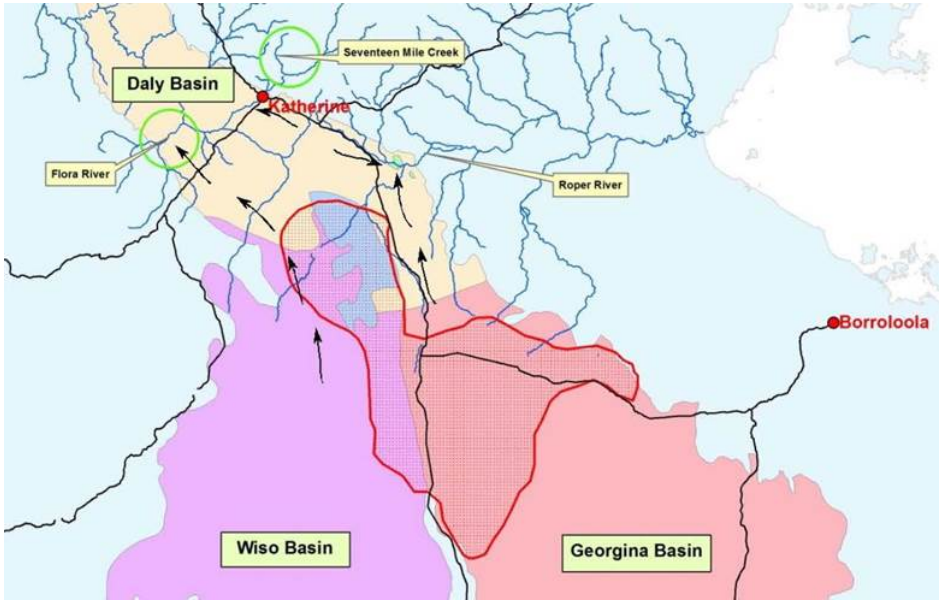
- Effective water management is crucial.
- Aquatic resources to be protected:
  - Surface water
  - Ground water (aquifers)
  - Aquatic ecosystems

Objectives

- Ensure sustainable use of surface & ground water
- Ensure quality of surface & groundwater is maintained
- Protect aquatic ecosystems

Beetaloo Sub-basin

- Case study - most prospective and best studied
- South of Mataranka to Elliott
- Semi-arid in north, Arid in south
- High quality groundwater (Cambrian Limestone Aquifer – Tindall Aquifer, Gum Ridge Aquifer)
- Surface water (temporary during wet season, details poorly known)

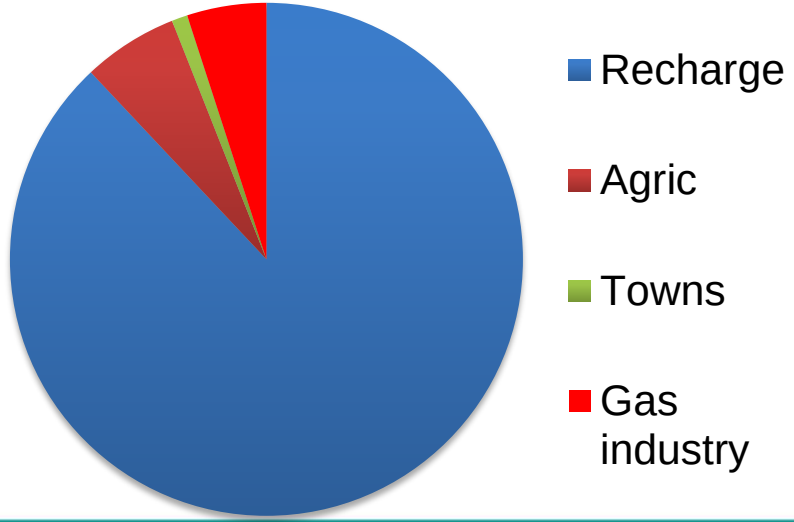


Groundwater use

- Regional – Cambrian Limestone Aquifer

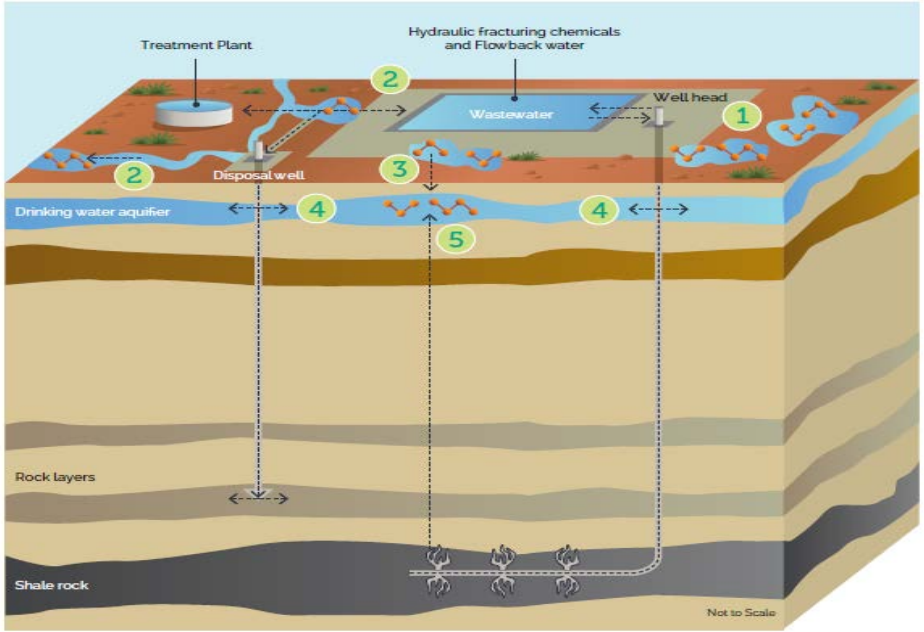
Still need:

- Better estimates of recharge rates
- Better estimates of local drawdowns



Risks to water quality

- Spills of fracking fluids and wastewater
- Contamination from leaky operating wells
- Contamination from abandoned wells



Water: knowledge gaps

- Groundwater resources
  - Recharge rates (north to south)
  - Local drawdown
- Aquatic ecosystems
  - temporary waterbodies
  - groundwater dependent ecosystems

Water: knowledge gaps

- Wastewater
  - Volumes & composition of flowback & produced water, collection, storage, treatment, disposal
  - Reuse (in hydraulic fracturing)
  - Likelihood of surface spills reaching the groundwater & remediation if this occurs

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Land

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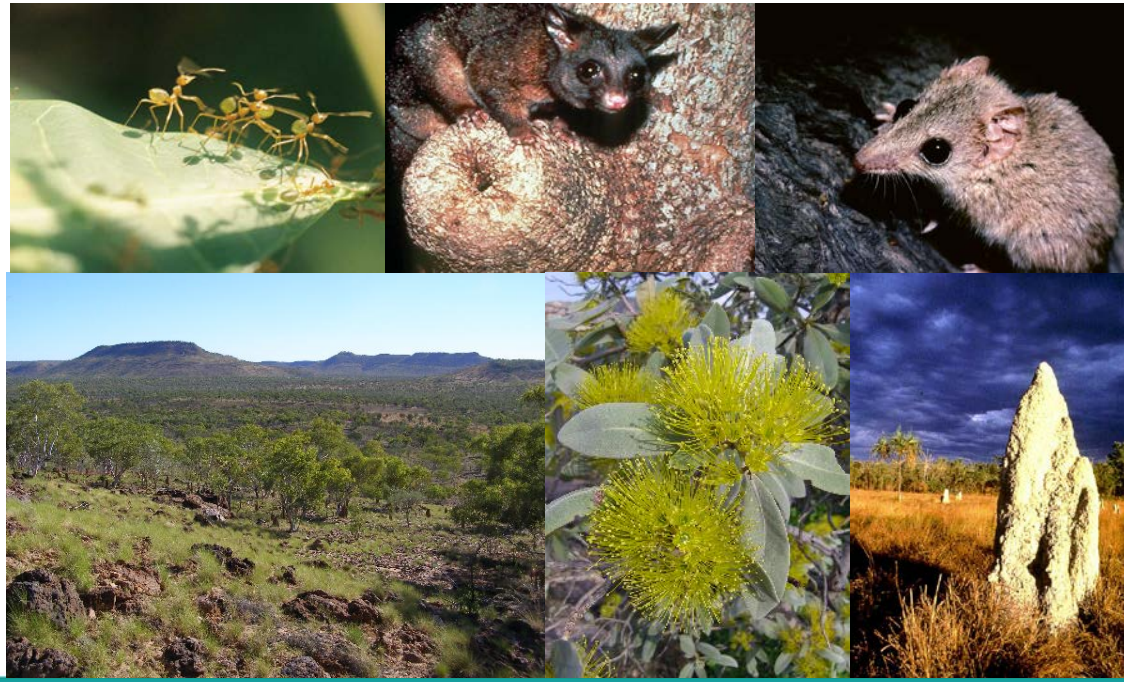
Land

1. Landscape amenity
2. Biodiversity and ecosystem health



Landscape amenity

- Landscape transformation
- Heavy-vehicle traffic

Biodiversity and ecosystem health

- Inappropriate location of development areas
- Spread of weeds
- Changed fire regimes
- Habitat loss and fragmentation
- Inappropriate siting of infrastructure
- Chemical spills

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Greenhouse gas emissions

Greenhouse Gases

Shale gas operations, from extraction through to use, will result in the emission of greenhouse gases such as methane (CH_4) and carbon dioxide (CO_2)

Climate Change

- Greenhouse gases, including hydrocarbons (methane and ethane) and carbon dioxide, will be released during hydraulic fracturing and the associated activities
- The potential burden of greenhouse gas emissions will be assessed by the Panel
- There will be cumulative risks associated with these activities

Other Issues

- Issues such as amenity, public health and air contamination arising from atmospheric emissions are covered by other relevant themes

Preliminary assessment: greenhouse gases

- Methane emissions dominate the upstream GHG emissions from shale gas. Can be reduced
- World-leading emission reduction standards can give methane emissions around 1.4 to 2%
- The life cycle GHG emissions are dominated by CO_2 (78%) for electricity generation
- Gross emissions from shale gas field (1000 TJ/ day), ~ 5% of Australia's GHG emissions
- If NG displaces coal from electricity production, represents a saving ~ 5% of Australia's GHG emission inventory
- If methane emission rates are lower than 3.3%, NGCC plants have lower climate impact than super critical, pulverised coal power

More reliable knowledge/ information

The Panel requires more reliable knowledge/ information on:

- Methane emissions
- Risk Assessment - There is insufficient information on the achievement of lower levels of methane emissions and the associated components of a risk assessment framework
- Abandoned wells - Information is needed on the emission rates from these wells

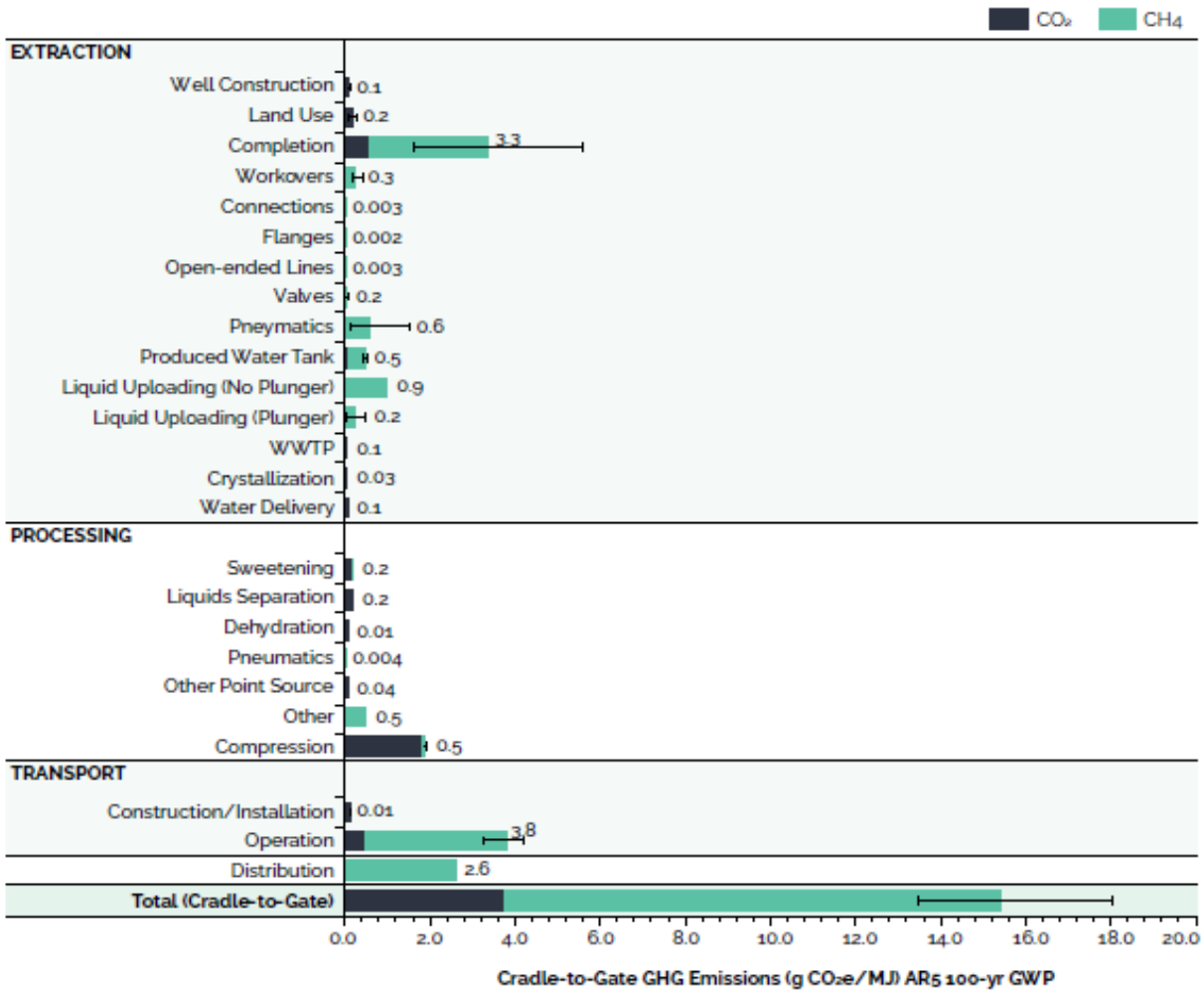
Emissions: preliminary view

The Panel has formed the preliminary view that to achieve satisfactory emission levels and to provide transparency, it is necessary to:

- Require compliance with world-leading standards for emission reduction
- Undertake baseline monitoring and development and production monitoring of methane emissions and ensure transparency
- The Panel is seeking commentary on the above

Emissions

Figure 9.1. Upstream Cradle-to-gate GHG Emissions for gas from an Appalachian shale gas field based on a methane GWP = 36. Source: Skone et al.[216]



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Public health

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Potential risks to public health

Two main approaches

- Formal site-specific Human Health Risk Assessments (HHRA) for chemicals
  - enHealth & other guidance; EIS requirements
- Risks to well-being and amenity
  - identify issues & possible mitigating factors

HHRA for released chemicals

- Identify chemicals of concern (CoC)
  - hydraulic fracturing fluids; geogenic chemicals; dusts
- Identify & quantify potential pathways for exposure for people in the vicinity*
  - contaminated water, dusts, airborne
- Contrast predicted exposures with health-based guidance values (including aggregated risks)

* U.S. experience & other literature reports suggest proximity to wells a significant limiting factor in estimating risk

Potential effects on well-being & amenity

- Stress associated with negotiating land access, impacts on property values etc
- Noise, dust and other ‘nuisances’
- Impacts of increased road traffic
- Impacts on indigenous culture & practices
- Other socio-economic impacts? (consultancy report)

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Aboriginal people and their culture

Aboriginal people and their culture

- Aboriginal people make up most of the resident populations in the areas of the shale-gas basins in the Northern Territory
- Aboriginal people are linked with their land (including waterbodies) by their ancient traditions and contemporary use of their land in accordance with those traditions

Aboriginal people and their culture

- As a community, they must be able to maintain their cultural traditions relating to that land in order that their ownership rights continue to be recognised, from one generation to the next

- Aboriginal communities are therefore particularly vulnerable to degradation of the landscape and the natural systems it supports

Aboriginal people and their culture

- It is the Panel's assessment that Aboriginal people have not yet been given enough information about the potential risks and benefits of hydraulic fracturing
- It is imperative that accurate information is provided to the Aboriginal groups likely to be directly affected by hydraulic fracturing well in advance of requirements for decision-making

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Social impacts

Social licence to operate

"… the ongoing acceptance or approval of an operation by those local community stakeholders who are affected by it and can affect its profitaibility"

Moffat and Zhang, 2014

Often easier to know when a project does not hold a social licence to operate than when it does

Parsons, Lacey and Moffat, 2014

Social impact assessment (SIA)

- Commissioned Coffey Services Australia Ltd through a public tender ($413,513)
- Develop SIA framework for potential unconventional shale gas industry in NT
- Apply the framework to communities in and around Beetaloo Sub-basin
- Identify likely social impacts and whether these impacts can be mitigated
- Due mid September, 2017

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Economic impacts

Economic impact assessment

- ACIL Allen Consulting was awarded a tender to undertake an economic impact assessment of the potential onshore unconventional shale gas industry in the NT
- Six tenders were received through the public tender process
- ACIL Allen will conduct a wide ranging study focussing on the actual and potential direct and indirect economic benefits, impacts and risks of hydraulic fracturing
- The cost of the ACIL Allen tender was $287,719

Economic impact assessment

The Inquiry has strong oversight of ACIL Allen's work, including the development of assumptions to be used in the modelling

Allen is required to update and report regularly to the Inquiry

ACIL Allen's report will be completed mid September 2017 and made publicly available

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Regulatory reform

Regulatory framework

"The design and implementation of a robust regulatory framework is the principal way by which the Government can ensure that any onshore unconventional shale gas industry develops in a manner that protects the environment, is safe to humans, and is consistent with community expectations.

There is, however, a real risk that the current regulatory framework in the NT may not achieve these objectives."

Current framework:

- *Petroleum Act 1984* (binding)
- *Petroleum (Environment) Regulations 2016* (binding)
- *Schedule of Onshore Petroleum Exploration and Production Requirements 2016* (not binding)

Key regulatory issues

The 'precautionary principle'

Rio Declaration 1992; Telstra Corporation Ltd v Hornsby Shire Council (2006) 67 NSWLR 256

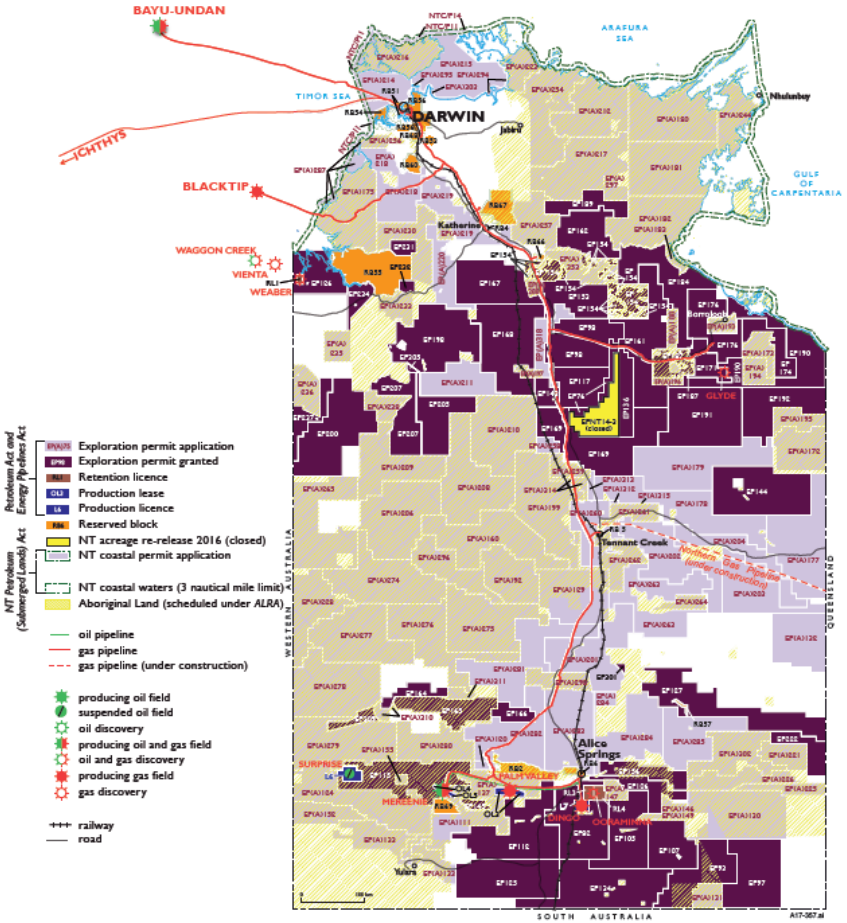
- "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."
- Requires:
  - the threat, based on scientific evidence, of serious or irreversible damage; and
  - scientific uncertainty regarding environmental damage.
- How to put into practice in the regulatory framework?

Key regulatory issues

‘No-go’ zones

- What are they?
- Where should they be?
- How should they be implemented?

Onshore petroleum titles and developments



Minimum standards

- Current framework is ‘objective based’, framed around outcomes
- ‘Prescriptive’ regulation is focussed on actions
- Which will ensure enforceable minimum standards?

Regulator: Department of Primary Industry and Resources

- Seen as not independent from industry
- Perceived to be not adequately resourced
- Not trusted by the community to regulate industry
- Legacy issues
- Remoteness of sites

Rehabilitation bonds

- Who is liable for any damage?
- How to ensure bonds are adequate?

Access to justice

- In relation to decisions made under the Petroleum Act, e.g. grant of a permit
- Ensuring those affected have appropriate access to justice
- Standing to sue
- Reversal of onus of proof
- Costs

Land access

Aboriginal land

- Right of veto at exploration stage only; not at production stage
- Compensation

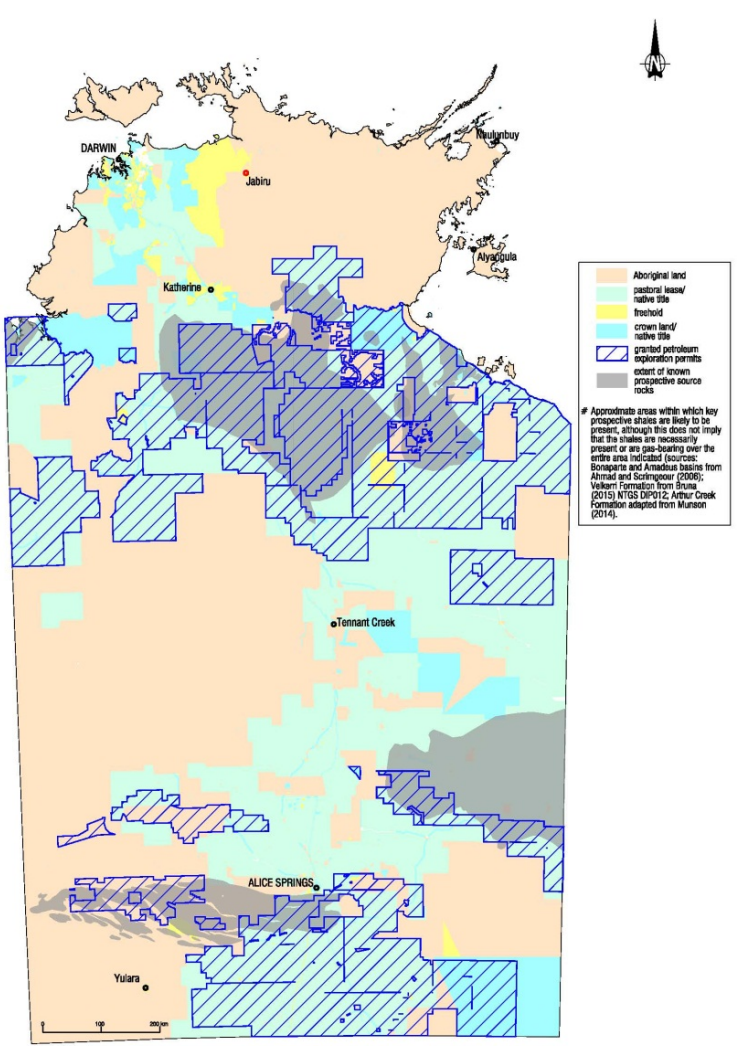
Native title

- *Native Title Act 1993* (Cth) enacted following *Mabo v Queensland (No 2)* (1992) 175 CLR 1
- No right of veto
- Requirement to enter into an Indigenous Land Use Agreement (ILUA)

Land access

Pastoral leases

- No right of veto. Should there be?
- Non-statutory land access agreements, which include compensation for deprivation of use or enjoyment
- Should there be a statutory land access agreement providing for guaranteed terms and provisions?



Future work

The Panel will consider options to:

- put the precautionary principle into practice (operationalise)
- ensure effective minimum standards are enshrined in legislation
- establish ‘no-go’ zones and determine where they should be
- increase trust in, independence, and resourcing, of a regulator and determine who that regulator should be
- make better provision for abandoned wells and rehabilitation.
- ensure greater access to justice
- ensure balanced and fair land access arrangements

Have Your Say

Anyone wishing to make a comment or provide a submission to the Inquiry is welcome to do so at any time.

Post

Post submission to:
Hydraulic Fracturing Inquiry
GPO Box 4396, Darwin
NT 0801

Email

Send your submission to:
fracking.inquiry@nt.gov.au

Online

Upload your submission to the Inquiry's Have Your Say page:
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