



GISERA | Gas Industry Social and Environmental Research Alliance

# Summary of research projects

GISERA is conducting research that addresses the social and environmental impacts and opportunities arising from onshore gas developments



# Ground and surface waters

## Improving the representation of the impact of CSG extraction in groundwater flow models for the Namoi region **N**

**SCOPE:** develop more representative models for estimating the groundwater impacts from coal seam gas well fields.

**OUTCOME:** improving the prediction of groundwater impacts by ensuring accurate representation of the effects of CSG production in the groundwater models being developed for the Namoi region.

## Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids **T**

**SCOPE:** to understand how typical onshore gas chemicals degrade in relevant aquifers and soil types.

**OUTCOME:** information about microbial communities in aquifers and soils, and understanding how microbes influence degradation of typical onshore chemicals in soils and aquifers. This data can be used to assess the health of an ecosystem.

## Characterisation of the stygofauna and microbial assemblages of the Beetaloo sub-Basin **T**

**SCOPE:** to better understand animals and microbes that live in subterranean groundwater.

**OUTCOME:** information about subterranean groundwater dependent ecosystems in the Beetaloo Sub-basin and Roper River system.

## Groundwater modelling and predictive analysis to inform CSG impact assessment, monitoring and management **N**

**SCOPE:** to undertake independent groundwater modelling and predictive analyses to inform CSG groundwater impact assessment and regulatory monitoring and management in the Narrabri Gas Project area.

**OUTCOME:** an improved modelling framework to more accurately estimate aquifer water balance under baseline development and future conditions including cumulative impacts and climate change.

## Microbial communities and their ability to degrade prospective chemicals used in coal seam gas activities **N**

**SCOPE:** to establish microbial community and chemical baselines in agriculturally important soils and surface and ground waters, and to assess and understand the capacity of microbes of these environments to degrade a range of chemicals likely to be used in CSG activities.



**OUTCOME:** more accurate assessment of environmental impacts from CSG development to the local Narrabri region through improved understanding of regional microbial diversity and their capacity to biodegrade chemicals likely to be used in CSG activities.

## Geochemical modelling and geophysical surveys to refine understanding of connectivity between coal seams and aquifers **N**

**SCOPE:** to integrate geochemical modelling and airborne geophysical surveys in the proposed coal seam gas development area in the Narrabri region of NSW.

**OUTCOME:** improved understanding of the connectivity between coal seams and overlying aquifers in the Narrabri region through high-resolution 3D realisations of the subsurface that represent continuous geological structures. This will provide additional information on the potential for connectivity pathways between CSG target formations and adjacent groundwater systems.

## Beetaloo basin shale long-term competency after decommissioning **T**

**SCOPE:** to quantify the self-sealing competency (creep behavior) of shales in the Beetaloo basin that sit between the target natural gas seams and the shallow Cambrian Limestone Aquifer.

**OUTCOME:** improved understanding of how decommissioned wells in the Beetaloo basin maintain their integrity over a long-term period.



## Background seismicity of Beetaloo Sub-basin and seismic hazard **T**

**SCOPE:** to establish a long-term baseline seismic monitoring catalogue that will characterise the current natural seismic activity and cultural seismic noise sources (e.g., quarry blasts) within the Beetaloo Basin and its surroundings.

**OUTCOME:** the project will provide important information about baseline seismic activity in the Beetaloo Basin to community and regulators, and estimate the potential impact of future earthquake scenarios.

## Baseline monitoring of groundwater properties in the Beetaloo Sub-basin **T**

**SCOPE:** to better understand the geochemical properties, recharge rates and recharge mechanisms of groundwater.

**OUTCOME:** information about the baseline geochemistry and groundwater flow characteristics in the Cambrian Limestone Aquifer.

## Improved approaches to long-term monitoring of decommissioned onshore gas wells **T**

**SCOPE:** investigation of options for long-term monitoring of well integrity in decommissioned onshore gas wells in the context of Northern Territory regulatory requirements.

**OUTCOME:** development of long-term well monitoring techniques and technologies to support best practice in onshore gas well decommissioning activities in the Northern Territory.

## Assessment of faults as potential connectivity pathways **N**

**SCOPE:** to assess the continuity and performance of aquitards separating shallow aquifers and coal seams within and near the proposed gas project development area south-west of Narrabri.

**OUTCOME:** improved understanding of sub-surface structures and potential fault zones that may act as pathways between target coal seams and shallow aquifers or surface water systems, and enhanced accuracy of future groundwater models in the Narrabri region.

## Baseline seismic monitoring of the Canning Basin **W**

**SCOPE:** establish a long-term baseline of seismic monitoring data that will characterise the current natural seismic activity and cultural seismic noise within the Canning Basin in Western Australia.

**OUTCOME:** this baseline study will distinguish any potential increase in seismic activity due to planned gas extraction operations from other seismic sources. This research addresses recommendations from the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia (2018).

## Fate of hydraulic fracturing fluids and geogenic hydrocarbons **T**

**SCOPE:** investigating chemicals and their lifecycle during hydraulic fracturing, in flow-back water produced after fracturing, and surface facilities in the Northern Territory.

**OUTCOME:** improved understanding of the degradation and transport of these chemicals within the subsurface, in flow-back water and in holding tanks and ponds in industry facilities.

## Onshore gas water lifecycle management options framework **T**

**SCOPE:** develop a water management framework with a focus on identifying sustainable options for managing onshore gas wastewater in the Northern Territory.

**OUTCOME:** fit-for-purpose management and water treatment alternatives that consider costs, and high-level environmental and social outcomes. The framework will guide industry and regulators to make optimal wastewater management decisions, with benefits to local communities, broader society and the environment.

## Decision support framework for groundwater development scenarios **S**

**SCOPE:** develop and test a decision support framework to improve management of groundwater resources.

**OUTCOME:** A science-based decision support framework to assist policy development and decision-makers to manage valuable water resources. Research outcomes will consider probable future groundwater use scenarios, taking account of climate change and various future water use patterns in the south east of South Australia.

## Microbial degradation of chemicals in aquifers of the Limestone Coast **S**

**SCOPE:** demonstrate the potential for microbial degradation of fluids and chemicals used by the onshore gas industry across the Tertiary Limestone Aquifer in the Limestone Coast region of south east South Australia.

**OUTCOME:** establish microbial community baselines in the Tertiary Limestone Aquifer. It will also examine microbial degradation in aquifer water samples of a range of chemicals likely to be used in onshore gas activities.

## Monitoring and microbial degradation of gas activity chemicals **T**

**SCOPE:** understand how typical onshore gas chemicals biodegrade in relevant aquifers and soil types in the Northern Territory.

**OUTCOME:** establish baseline information about microbial communities in aquifers and soils, and improved understanding of how microbes influence the degradation of chemicals typically used in the onshore gas industry. This information can be used to gauge the health of groundwater ecosystems.

# Agricultural land management

## Putting land management knowledge into practice **T**

**SCOPE:** develop high-quality spatial data to help landholders, regulators and the gas industry to evaluate the design and placement of gas infrastructure, protect surface water and vegetation, and reduce erosion, soil damage and dust.

**OUTCOME:** modern data visualisation techniques presenting spatial data relating to landscape processes in the Beetaloo Sub-basin in a 'virtual landscape' using augmented reality technology. Complex processes such as hydrology, soil loss or pasture dynamics can be more easily understood, supporting best practice management of potential environmental risk.

## Perspectives on risk to local markets and industries **S**

**SCOPE:** explore potential market impacts and associated concerns relating to the value of place of origin labelling and branding arising from conventional gas development in the south east of South Australia.

**OUTCOME:** Results from this research will assist community understanding and inform public communications and policy development.

# Greenhouse gas and air quality

## Methane emissions from well drilling to completion in the Beetaloo **N**

**SCOPE:** quantify fugitive methane emissions from well construction and completion activities from unconventional shale petroleum exploration in the Beetaloo Sub-basin using autonomous emissions monitoring stations.

**OUTCOME:** ability to compare actual measured results with estimated results to verify the adequacy of existing calculated emission estimates. This provides a unique opportunity to gather data about industry operations while they are underway and to accurately determine the level of fugitive methane emissions associated with well construction and completions.

## Offsets for life cycle greenhouse gas emissions of onshore gas in the **N**

**SCOPE:** identify feasible options to offset life cycle greenhouse gas emissions emitted in Australia associated with scenarios of new production and Australian consumption of onshore gas extracted from the Northern Territory's Beetaloo Sub-basin.

**OUTCOME:** scenario analysis will represent potential gas extraction, coupled with technical calculations on the GHG emissions implications of those scenarios. An important aspect of developing natural gas is the estimation of fugitive methane emissions from production scenarios.

# Health impact

## Potential human health impacts from CSG activities **Q**

**SCOPE:** establish processes and governance to ensure research quality, define the project boundary, conduct hazard identification and exposure pathways, and screen data.

**OUTCOME:** identify potential chemical and physical hazards and exposure pathways assess the quality of existing data and gaps in the data collected. Key issues will be selected for further in-depth assessment as part of the project to enable the health study framework to be demonstrated in its entirety.



# Social and economic

## Community well-being and attitudes to conventional gas **S**

**SCOPE:** measure levels of perceived risk, benefits, knowledge, and other underlying drivers of trust and social acceptance of conventional gas development in SA's south east, and develop baseline data on community values, well-being and future expectations.

**OUTCOME:** baseline information about community well-being, perceptions, expectations and resilience for conventional gas development, to improve awareness and knowledge.

## Monitoring wellbeing and attitudes to CSG (pre-construction phase) **N**

**SCOPE:** monitor any changes in local community wellbeing and attitudes to coal seam gas (CSG) during the pre-construction phase of the Santos Narrabri Gas Project in NSW.

**OUTCOME:** Results of this research contribute towards a comprehensive longitudinal study over the next five years around community wellbeing and local attitudes towards CSG in Narrabri. This research fills a gap between the pre-approval baseline assessment survey that was conducted by CSIRO's GISERA in 2017 and a planned future survey to be conducted during the construction phase, should the project proceed.

## The role of gas in South Australia **S**

**SCOPE:** clarify the role of natural gas in meeting the state's renewable energy, security, emissions and energy pricing goals.

**OUTCOME:** define a least cost technical pathway towards 100 per cent renewable electricity and a hydrogen industry, which supports an eventual zero net emissions in South Australia, consistent with South Australia's Climate Change Strategy 2015–2050 – Towards a Low Carbon Economy.



# Biodiversity

## Managing impacts to biodiversity from roads and pipelines in the Beetaloo **N**

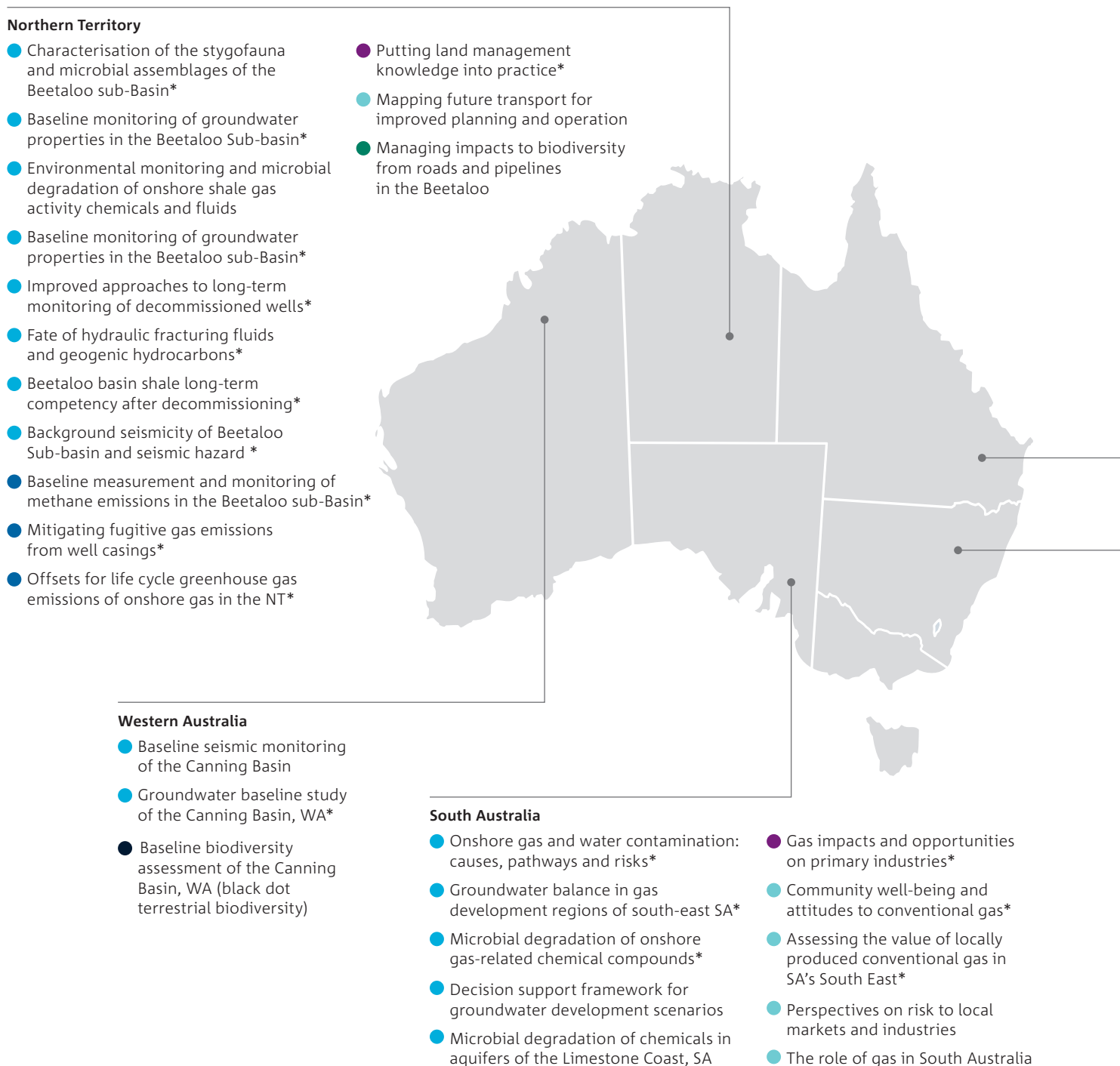
**SCOPE:** investigate how roads, pipelines and other linear transport infrastructure may impact biodiversity in the Beetaloo Sub-basin during the development of an onshore gas industry.

**OUTCOME:** new scientific information about potential biodiversity impacts to help identify areas that are most threatened by infrastructure development and assist management approaches and decision-making to reduce risk to biodiversity while facilitating development.



# Research projects by region

GISERA’s integrated research program and regional focus ensures that its research identifies cumulative impacts from onshore gas developments and informs coordinated responses across industry, community and government.







### Queensland

- Hydrocarbons in groundwater, Surat and Bowen basins\*
- Geochemical responses to re-injection\*
- Re-injection of CSG water\*
- Isotope and geochemical groundwater baseline study\*
- High performance groundwater modelling\*
- Improving groundwater flow models\*
- Groundwater contamination risk assessment\*
- Air, water and soil impact of hydraulic fracturing\*
- Air, water and soil impact of hydraulic fracturing: Phase 2\*
- Priority threat identification, management and appraisal\*
- Fire ecology of grassy woodlands\*
- Ensuring biodiversity offset success: the right kind of seed for a rare daisy\*
- Habitat selection by two focal species\*
- Guidelines for offset population sizes\*
- Sustaining turtles and their homes\*
- Methane seepage in the Surat Basin\*
- Ambient air quality in the Surat Basin\*
- Greenhouse gas (GHG) emission assessment of the Surat Basin Gas Reserve\*
- Preserving agricultural productivity\*
- Shared space\*
- Gas farm design\*
- Making tracks, treading carefully\*
- Without a trace\*
- Telling the story\*
- Inside the heard\*
- Potential human health impacts from CSG activities
- Monitoring regional transition\*
- Understanding community aspirations\*
- Economic assessment and forecasting project\*
- Community functioning and well-being\*
- Community function and well-being Survey 2\*
- Trends in community wellbeing and attitudes to CSG development, Survey 3\*

### New South Wales

- Impacts of CSG depressurisation on the Great Artesian Basin (GAB) flux\*
- Spatial design of groundwater monitoring network in the Narrabri Gas Project area\*
- Improving the representation of the impact of coal seam gas extraction in groundwater flow models for the Namoi region
- Groundwater contamination risk assessment\*
- Assessment of faults as potential connectivity pathways
- Groundwater modelling and predictive analysis to inform CSG impact assessment, monitoring and management
- Microbial communities and their ability to degrade prospective chemicals used in coal seam gas activities
- Geochemical modelling and geophysical surveys to refine understanding of connectivity between coal seams and aquifers
- Regional methane emissions in NSW CSG basins\*
- Human health effects of CSG activity: Review and study design\*
- Analysing economic and demographic trajectories in NSW regions experiencing CSG development and operations\*
- Social baseline assessment of the Narrabri region of NSW in relation to CSG development\*
- Decommissioning pathways for CSG projects\*
- Assessing and projecting on-shore gas effects on regional economic activity in NSW
- Assessing the value of locally produced conventional gas in SA's South East

### Research area

- Surface and groundwater
- Terrestrial biodiversity
- Marine environment
- Greenhouse gas and air quality
- Agricultural land management
- Health impact
- Social and economic
- Biodiversity

\*These projects have been completed and their reports are available at [gisera.csiro.au](http://gisera.csiro.au)

**Further information | 1300 363 400 | [gisera@csiro.au](mailto:gisera@csiro.au) | [gisera.csiro.au](http://gisera.csiro.au)**

GISERA is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, greenhouse gas emissions, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research.