



GISERA

Gas Industry Social and Environmental Research Alliance

Summary of research projects

MAY 2018



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



Australian Government
Department of Industry,
Innovation and Science



Supported by
Government of
South Australia

Surface and groundwater



Hydrocarbons in groundwater, Surat and Bowen basins Q

SCOPE: review and assess the presence of organic compounds in groundwater found in the Surat and Bowen basins using existing open source and company held data.

OUTCOMES: information and methods to assess possible sources of hydrocarbons in groundwater to help differentiate naturally occurring hydrocarbons and those potentially introduced during gas extraction process.

Isotope and geochemical groundwater baseline study* Q

SCOPE: characterise the baseline geochemistry of groundwater and formation water prior to and during initial stages of development to understand groundwater age and origin.

OUTCOMES: baseline measures of groundwater quality and protocols for monitoring changes in groundwater quality, during and after development.

Geochemical responses to re-injection* Q

SCOPE: understand and quantify aquifer reactions occurring due to re-injection of CSG water, and their impacts on water quality.

OUTCOMES: methods for predicting water quality changes resulting from CSG water re-injection.

Improving groundwater flow models Q

SCOPE: measuring and modelling specific chemicals called environmental tracers to gain a better understanding of the speed and direction of groundwater flow.

OUTCOMES: new data and modelling approach to assess flow rates and volumes of usable groundwater resources in CSG regions in Queensland.

Re-injection of CSG water* Q

SCOPE: understand, quantify and manage clogging of injection wells during re-injection of CSG water permeates, brines and blends.

OUTCOMES: strategies to manage clogging of re-injection wells to maximise re-injection volumes.

High performance groundwater modelling* Q

SCOPE: determine the feasibility of large scale re-injection schemes.

OUTCOMES: models that assess the feasibility of large re-injection schemes and predict how re-injection may reduce impacts from CSG development.

Air, water and soil impact of hydraulic fracturing Q

SCOPE: to design an intensive monitoring campaign that will measure the air, water and soil impacts of hydraulic fracturing of production wells in the Surat Basin.

OUTCOMES: a report summarising the current state of knowledge regarding sources of air, water and soil pollutants associated with CSG extraction using hydraulic fracturing, a peer-reviewed design for a measurement program that will provide enhanced information of the impacts of hydraulic fracturing and a report presenting an analysis of air, water and soil quality before commencement of hydraulic fracturing activity.

Impacts of CSG depressurisation on the Great Artesian Basin (GAB) flux N

SCOPE: improve the understanding of the GAB groundwater flow in the Pilliga region through integration of existing information from models, hydrochemical data and environmental tracers.

OUTCOMES: assess the chances of extreme changes in GAB groundwater flux (flow volumes) as a result of CSG development using state of the art uncertainty analysis and modelling.

Groundwater contamination risk assessment N Q

SCOPE: assessing the likelihood of groundwater contamination from hydraulic fracturing and wellbore damage.

OUTCOMES: quantitative estimate of the risk of groundwater contamination at a basin/sub-basin scale. This will help management plans and strategies to reduce the risk of surface and groundwater contamination and provide communities a better understanding of potential impacts to local water resources.

Spatial design of groundwater monitoring network in the Narrabri Gas Project area N

SCOPE: analysis and design of groundwater bore networks for optimal groundwater monitoring and early detection of changes.

OUTCOME: optimal spatial design of groundwater monitoring networks to improve confidence around predicted groundwater impacts, and help minimise the risk of environmental damage.

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.

Air, water and soil impact of hydraulic fracturing: Phase 2 Q

SCOPE: this project involves undertaking a comprehensive monitoring campaign to measure the air, surface water, groundwater and soil impacts of hydraulic fracturing of gas production wells in the Surat Basin, Queensland.

OUTCOMES: a series of reports summarising the impacts of hydraulic fracturing on air, water and soil quality, developed through a comprehensive on-site program of measuring air, water and soil before, during and after hydraulic fracturing activity.

*These projects have been completed and their reports are available at gisera.csiro.au

Agricultural land management

Preserving agricultural productivity*

SCOPE: assist in the preservation of agricultural productivity during land use change.

OUTCOMES: developing methods for most equitably and/or cost-effectively preserving agricultural productivity.

Gas farm design*

SCOPE: understand how to design farms for a new mixed land use.

OUTCOMES: design principles and practices that optimise farm and gas infrastructure and operations, minimising negative impacts and maximising benefits.

Without a trace*

SCOPE: identify the nature and likely extent of damage to agricultural soils, and methods for avoiding and improving soils.

OUTCOMES: methods for installing and operating gas infrastructure that avoids soil damage, and novel methods for rehabilitating damage that does occur.

Telling the story*

SCOPE: share understanding of changes on farms and in towns during CSG development in the Surat area.

OUTCOMES: development of a detailed landscape map showing changes during CSG developments and face-to-face engagements at local shows or community events in the Surat region.

Shared space*

SCOPE: understand how farmers from a range of production systems (extensive grazing to intensive cropping) perceive and value CSG developments on their and others' farms.

OUTCOMES: information that assists farmers and developers to negotiate means of co-existence that maximise



benefits and minimise social and economic costs.

Making tracks, treading carefully*

SCOPE: understand the direct and indirect impacts of tracks and traffic on invasive species and erosion in agricultural landscapes.

OUTCOMES: guidelines for quantifying, monitoring and managing weed and erosion threats.

Inside the heard

SCOPE: monitoring grazing land with coal seam gas (CSG) infrastructure to better understand the impacts of CSG infrastructure, traffic and dust on animals and pastures.

OUTCOMES: a detailed study of livestock behaviour, pastures, soil processes, and dust deposition for a real CSG property.

Terrestrial biodiversity

Priority threat identification, management and appraisal*

SCOPE: identify and understand the broad range of existing and new threats to biodiversity across a CSG development region.

OUTCOMES: determine which conservation management activities will best mitigate the risks to biodiversity.

Fire ecology of grassy woodlands*

SCOPE: determine the sensitivity of the region's flora and fauna to changed fire regimes, and the thresholds at which changed fire regimes cause substantial ecological impact.

OUTCOMES: advice on how to best manage the biodiversity impacts of altered fire regimes associated with CSG development.

Habitat selection by two focal species*

SCOPE: study two species, the Golden-tailed gecko and Glossy black-cockatoo, to assess the range of impacts from CSG development in south-west Queensland on their habitat.

OUTCOMES: management options for the Golden-tailed gecko and Glossy black-cockatoo habitats to ensure their long-term endurance.



Ensuring biodiversity offset success: the right kind of seed for a rare daisy*

SCOPE: identify genetic and demographic factors that may limit the success of establishing a rare daisy (*Rutidosis lantana*) in a new location.

OUTCOMES: best practice guidelines for moving the *Rutidosis lantana*, a rare daisy, to a new location. The guidelines will help to minimise biological limits to reproductive success and maximise population viability of the daisy.

Guidelines for offset population sizes

SCOPE: improve the understanding of how ecological and biological traits of rare species of plants, commonly encountered in restoration projects, and different environmental factors determine viable population sizes by using computer models.

OUTCOMES: evidence-based guidelines for the size of plant populations needed to maximise establishment and persistence of rare plant species.

Health impact

Human health effects of CSG activity: Review and study design* N

SCOPE: review current information to design a study on the health effects of CSG activities based on community stakeholder, governmental, expert consultation group, and industry input.

OUTCOME: comprehensive study design to investigate impacts of CSG activity on human health, including development of a conceptual model to inform the study design.



Marine environment

Sustaining turtles and their homes* Q

SCOPE: understand how sediments from dredging and discharges affect seagrass and turtles.

OUTCOMES: quantifying the risks to turtle populations from dredging and increased boat traffic.

Greenhouse gas and air quality

Methane seepage in the Surat Basin Q

SCOPE: detect and measure methane seeping from underground in the Surat Basin, and identify sources of methane to provide a baseline of methane emissions on a regional scale.

OUTCOMES: a methane emissions data set that can be used to compare changes in methane concentrations as coal seam gas production in the Surat Basin increases.

Ambient air quality in the Surat Basin Q

SCOPE: comprehensive assessment of air quality in the Surat Basin region in Queensland using air quality measurement network and modelling.

OUTCOMES: identify the impact of CSG production activities on air quality in the Surat region.



Greenhouse gas (GHG) emission assessment of the Surat Basin Gas Reserve Q

SCOPE: analysis of the whole of life cycle GHG emissions, including extraction, transportation and usage of CSG in the Surat Basin.

OUTCOMES: assessments of benefits and risks related to the extraction, transport and usage of gas in terms of their GHG emission footprint.

Regional methane emissions in NSW CSG basins* N

SCOPE: identify and quantify methane emission sources such as CSG infrastructure, feedlots, coal mining, legacy bore holes in the Pilliga region.

OUTCOMES: detailed inventory and map of methane emissions for the Pilliga region that can be used to compare emissions once large scale gas extraction starts.

Social and economic

Monitoring regional transition* **Q**

SCOPE: synthesise existing knowledge on the nature of rural socio-economic transitions occurring as a result of resource developments, and track the social impacts of regional economic change.

OUTCOMES: identify ways to help local communities in responding to resource development in order to maximise social benefit.

Understanding community aspirations* **Q**

SCOPE: identify community aspirations and their overlaps and/or disparities with existing resources, industry, and policy trajectories. Specifically, to understand how different community segments see the future of the region and how these reflect the economic and policy avenues for the region.

OUTCOMES: help inform sound industry and policy activities to satisfy the social licence to operate.

Economic assessment and forecasting project* **Q**

SCOPE: understand future impacts on regional economies and how local businesses can respond.

OUTCOMES: forecasts calculating likely economic effects during the operations phase and lessons to support local businesses.

Community functioning and well-being* **Q**

SCOPE: identify principal indicators of community function and well-being, the resources and strategies necessary for enabling and enhancing community responses, and how communities respond to major developments in their region.

OUTCOMES: inform strategic investments that will help maintain or enhance community function and well-being.

Community function and well-being survey 2* **Q**

SCOPE: conduct a community well-being survey to measure the changes since the end of the construction and start of the operations phases and compare results with the Survey 1 in 2014.

OUTCOMES: identify strategies that can be enacted by local and state government to proactively reduce stresses associated with rapid change and also to take advantage of opportunities arising from resource development.

Analysing economic and demographic trajectories in NSW regions experiencing CSG development and operations* **N**

SCOPE: identify current levels and trajectories of economic, social and demographic variables in CSG regions

within NSW and analyse whether or not the CSG industry could change the trajectory of these variables.

OUTCOMES: comprehensive baseline assessment of economic, social and demographic characteristics of CSG regions in NSW and the potential impacts of CSG on these characteristics.

Social baseline assessment of the Narrabri region of NSW in relation to CSG development* **N**

SCOPE: understand and measure attitudes, perceptions and expectations that exist within the community with respect to CSG development, and current levels of community wellbeing and community resilience.

OUTCOMES: baseline information about the community's wellbeing, perceptions, expectations and resilience in relation to CSG development.

Decommissioning pathways for CSG projects **N**

SCOPE: review regulatory frameworks in relation to principles derived from international literature and consider social concerns with regard to decommissioning of wells and well pad infrastructure.

OUTCOME: recommendations for an integrated approach to improving the social, economic and environmental effectiveness of decommissioning of wells and well pads.

Trends in community wellbeing and attitudes to CSG development, Survey 3 **Q**

SCOPE: monitor and communicate changes and trends in community wellbeing, resilience and attitudes to CSG development across different phases of industry operation in south west Queensland.

OUTCOME: a more comprehensive understanding of community wellbeing and attitudes to CSG over time and between regions to enable more strategic and proactive policy and planning around CSG development.

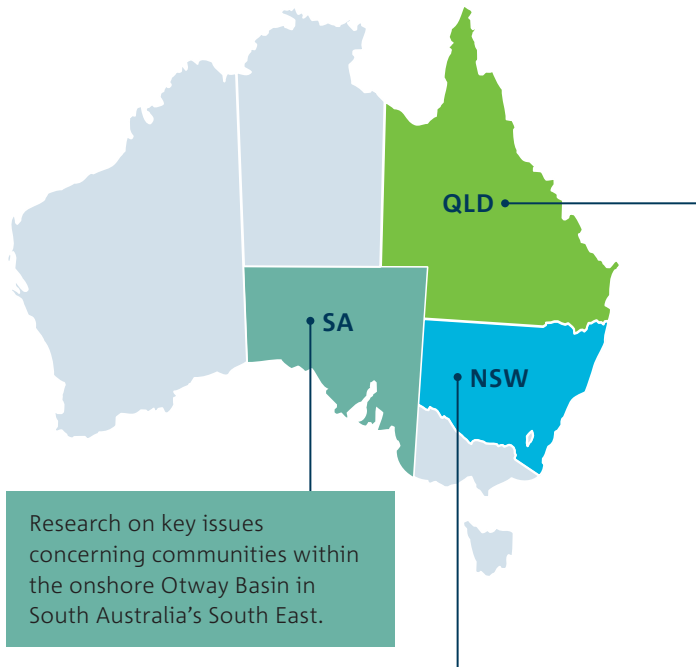


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Q Queensland **N** New South Wales

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.



Surface and groundwater:

- 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

Greenhouse gas and air quality:

- Regional methane emissions in NSW CSG basins*

Social and economic:

- 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

Health impact:

- Human health effects of CSG activity: Review and study design*

Surface and groundwater:

- 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

Marine environment:

- Sustaining turtles and their homes*

Greenhouse and air quality:

- Methane seepage in the Surat Basin
- Ambient air quality in the Surat Basin
- Greenhouse gas (GHG) emission assessment of the Surat Basin Gas Reserve

Agricultural land management:

- Preserving agricultural productivity*
- Shared space*
- Gas farm design*
- Making tracks, treading carefully*
- Without a trace*
- Telling the story*
- Inside the heard

Terrestrial biodiversity:

- 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

Social and economic:

- 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

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ABOUT GISERA

The Gas Industry Social and Environmental Research Alliance (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, 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. Visit gisera.csiro.au for more information about GISERA's governance structure, projects and research findings.

Further information: 1300 363 400 | gisera@csiro.au | gisera.csiro.au