

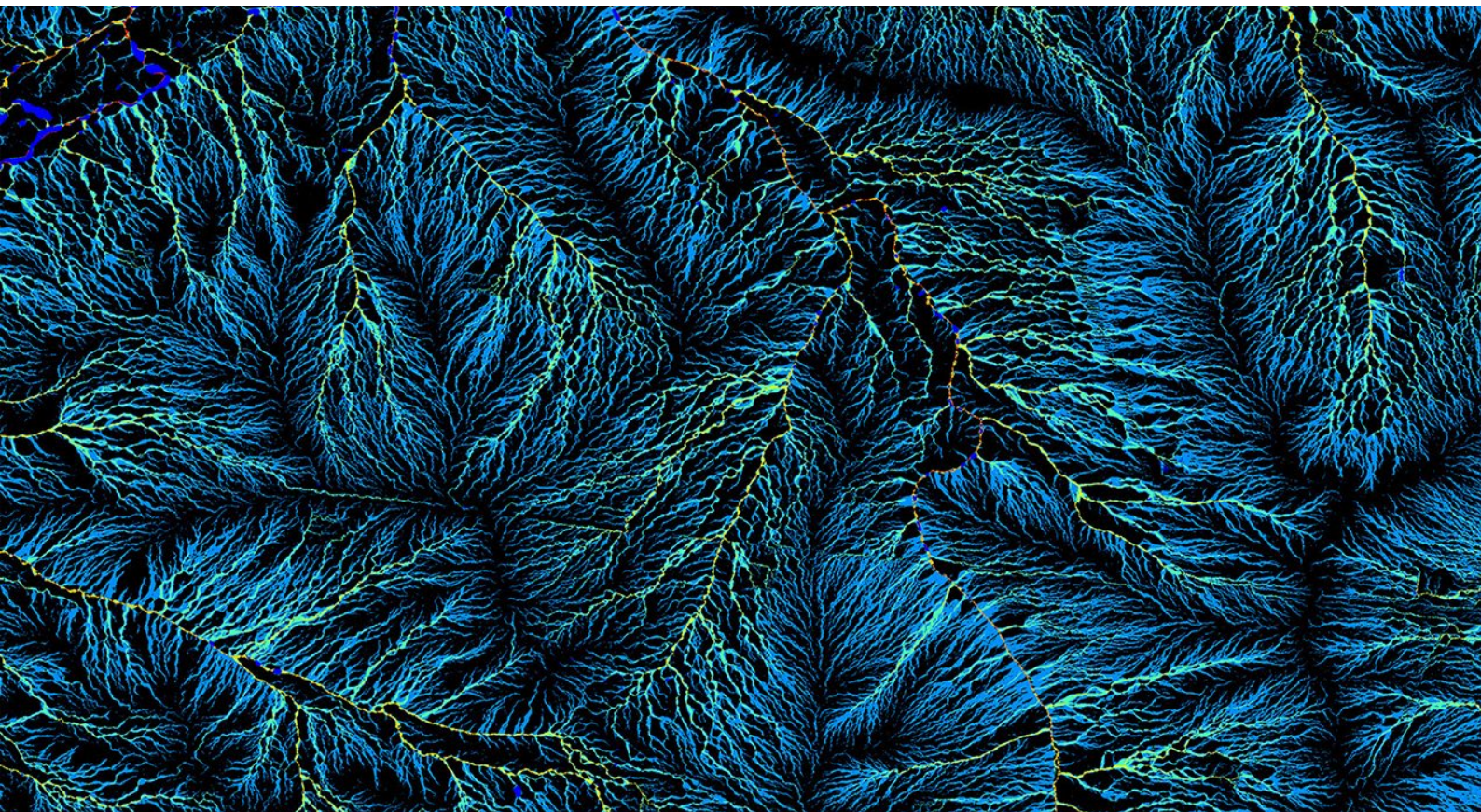


Australia's National
Science Agency

GISERA | Gas Industry Social and Environmental Research Alliance

Annual Research and Development Plan, Budget and Summary

2022-23



Contents

1	Director's summary	3
	Looking ahead.....	3
2	Governance.....	5
	Research Advisory Committees' activities.....	6
	Project modifications and progress reporting.....	9
3	Consolidated Budget.....	9
	3.1 Consolidated Budget	9
	3.2 Research projects by region	14
4	Queensland R&D Plan & Budget.....	16
	4.1 Queensland Investment profile.....	16
	4.2 Queensland research ideas being discussed for 2022/23.....	22
5	NSW R&D Plan & Budget	24
	5.1 NSW Investment profile	24
	5.2 NSW research ideas being discussed for 2022/23	29
6	South Australia R&D Plan & Budget	30
	6.1 South Australia Investment profile	30
	6.2 South Australia research ideas being discussed for 2022/23	33
7	Northern Territory R&D Plan & Budget.....	34
	7.1 Northern Territory Investment profile	34
	7.2 Northern Territory research ideas being discussed for 2022/23	39
8	Western Australia R&D Plan & Budget.....	40
	8.1 Western Australia Investment profile.....	40
	8.2 Western Australia research ideas being discussed for 2022/23	43
9	Proposed management and communication budget for 2022/23	45
10	Communication.....	47
	10.1 Overview.....	47
	10.2 Communication outputs.....	48
	10.3 Stakeholder Engagement	50

COVER: Image of predicted water-flow path across a landscape in Western Downs region of Queensland (CSIRO GISERA project [Making tracks, treading carefully](#))

1 Director's summary

The CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA) is a national collaboration between CSIRO, Commonwealth, state and territory governments, and industry, established in 2011 to undertake publicly-reported, peer-reviewed social and environmental research.

This is the eleventh Annual Research & Development Plan, Budget and Summary of the CSIRO's GISERA. GISERA's research program has been operational for approximately 11 years.

The 2021-22 financial year progressed the national expansion of CSIRO's GISERA, with a total nine new projects approved taking the total number of GISERA projects to 79 and total research investment to \$39,689,453¹.

GISERA's primary objectives remain to:

- carry out independent research and improve and extend knowledge of social and environmental impacts and opportunities of onshore gas projects, primarily for the benefit of communities living in gas development regions and the broader public
- inform governments, regulators and policy-makers about key issues regarding policy and legislative frameworks for the gas industry
- improve gas industry operations in regions where exploration and production activities are occurring.

CSIRO ensures all output and activities during the year contribute to GISERA's credibility, trust and respect through the open and transparent conduct and communication of its research and synthesis activities. All GISERA results and research outputs including scientific reports, journal papers and supporting communication products such as factsheets, communiques and online articles, are available to view and download at www.gisera.csiro.au.

Looking ahead

CSIRO through its GISERA activities will continue to engage with stakeholders in each of the states and territories to learn about new or evolving areas of concern associated with onshore gas development.

Plans for the 2022-23 year include the development of the next tranche of research projects in Queensland, New South Wales, South Australia, Western Australia and the Northern Territory.

For the first time since GISERA was established, CSIRO will look to establish broader national-interest projects.

The scale of GISERA research activity in CSIRO continues to increase, with the involvement of over 224 researchers over the life of GISERA across the following business units:

¹ This includes CSIRO in-kind contribution.

- Energy
- Land & Water
- Mineral Resources
- Oceans & Atmosphere
- Agriculture & Food
- Health & Biosecurity
- Manufacturing
- Data 61
- National Collections & Marine Infrastructure
- Space & Astronomy.

We seek to recruit and retain researchers of the highest distinction and potential, and we also explore broader research collaboration opportunities as we continue our planned activities in Queensland, New South Wales, South Australia, Northern Territory and Western Australia.

2 Governance

A key function of CSIRO's GISERA is to undertake research on issues of direct community interest using funding supplied by the Commonwealth and state governments and gas industry. To ensure independence of CSIRO research, a robust governance framework has been created. The framework uses external stakeholder-dominated Research Advisory Committees (RAC) in New South Wales, Queensland, South Australia, Northern Territory and Western Australia to approve projects and allocate research funds.

A new national-interest RAC will also be established to consider national scale projects. It will comprise one Commonwealth Government representative, one Tier 1 Industry representative (drawn from the State or Territory RACs) and at least three independent representatives (also drawn from the State or Territory RACs).

The RACs are responsible for approving the allocation of research funds to projects which meet the community objectives of addressing issues of concern. The composition and membership of the RACs are critical to the success of GISERA and comprise of a majority of esteemed and respected independent participants from the communities in which gas development is occurring.

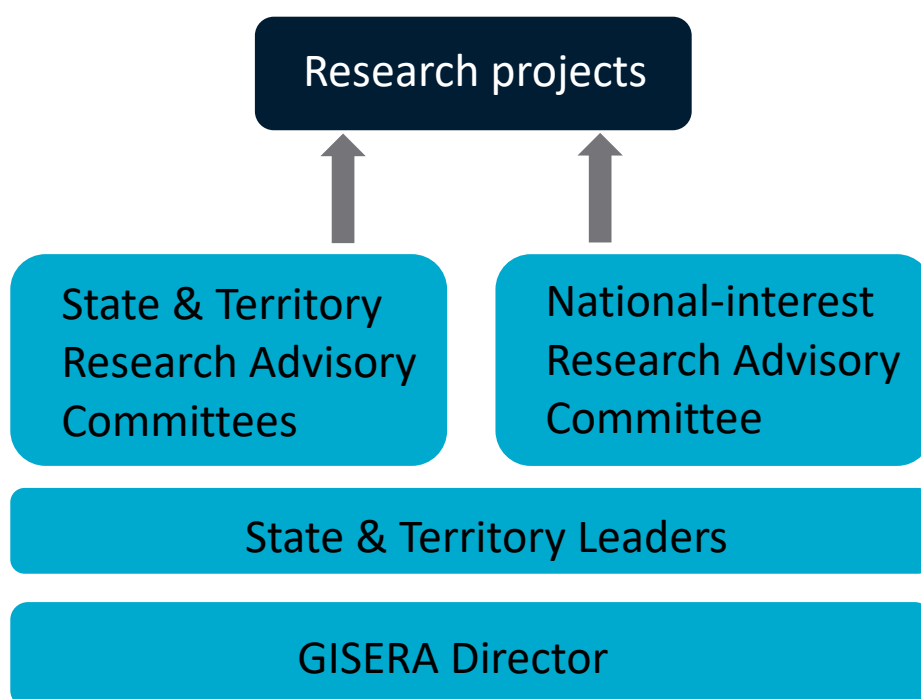


Figure 1 GISERA governance framework. Research projects and funds are approved by Research Advisory Committees, the majority of which are from local community and non-governmental organisations.

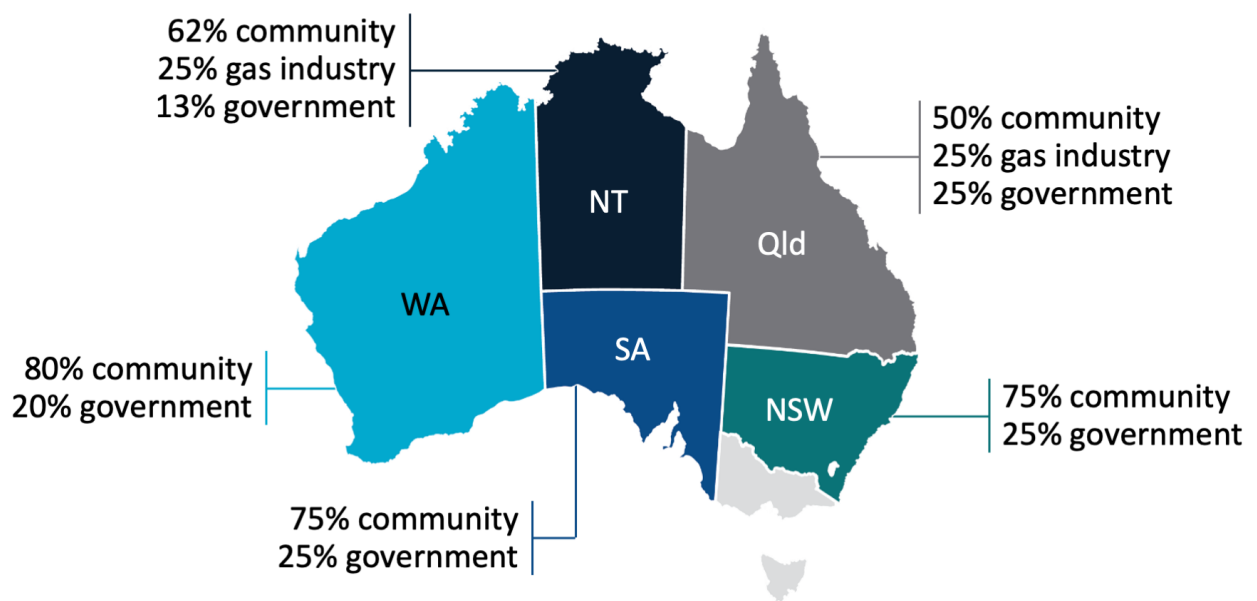


Figure 2 GISERA Research Advisory Committee composition across each of the states and territories

Research Advisory Committees' activities

Northern Territory

The Northern Territory Research Advisory Committee met in April 2022, resulting in:

- Approval of a land and infrastructure project titled 'Background Seismicity of Beetaloo Sub-Basin and Seismic Hazard'. This project will establish long-term background seismic data to characterise the current natural seismic activity in the Beetaloo Sub-basin in the Northern Territory. This baseline data can then be used to distinguish any possible increases in seismic activity resulting from future gas development and operations in the region.
- Approval of a land and infrastructure project titled 'Beetaloo basin shale long-term competency after decommissioning'. This project will improve understanding of how decommissioned wells in the Beetaloo basin maintain their integrity over the long-term. This project aims to quantify the self-sealing competency of shales in the Beetaloo basin that sit between the target natural gas seams and the shallow Cambrian Limestone Aquifer.

The Northern Territory Research Advisory Committee met again in June 2022, resulting in:

- Approval of a surface and groundwater project titled 'Examination of stygofauna ecosystems of the Beetaloo Sub-basin'. This research aims to build an understanding of the extent to which stygofauna present in bores reflect their presence more widely within aquifers. It also aims to understand the physical and chemical drivers that may determine where stygofauna exist and how communities may be connected.

Out of session, the Northern Territory Research Advisory Committee provided:

- Approval to proceed with the final two stages of Onshore gas water lifecycle management options framework project.

Three projects were completed during this reporting period:

- ‘Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids’
- ‘Long-term monitoring of decommissioned onshore gas wells’
- ‘Mapping future transport passages and volumes for improved planning and operation’

Overall, seven projects are now complete in the Northern Territory.

New South Wales

The New South Wales Research Advisory Committee met in April 2022, resulting in:

- Approval of surface and groundwater project titled ‘Microbial communities and their ability to degrade prospective chemicals used in coal seam gas activities’. This research will help improve understanding of the fate of chemical compounds used in coal seam gas (CSG) activities in the region if these compounds were to come into contact with the environment.
- Approval of surface and groundwater project titled ‘Geochemical modelling and geophysical surveys to refine understanding of connectivity between coal seams and aquifers’. This project will further improve our knowledge of groundwater systems in the Gunnedah and Surat Basins in the Narrabri region and refine the conceptual understanding of potential for hydrogeological connectivity pathways between shallow aquifers.
- Approval of surface and groundwater project titled ‘Groundwater modelling and predictive analysis to inform CSG impact assessment, monitoring and management’. This project will undertake independent groundwater modelling and predictive analyses to inform CSG groundwater impact assessment and regulatory monitoring and management in the Narrabri Gas Project (NGP) area.

One project was completed during this reporting period:

- ‘Assessment of the influence of geological structures on aquifer connectivity in the Pilliga Forest area, NSW – an integrated hydrogeological, geophysical, hydrochemical and environmental tracer approach.’

Overall, 11 projects are now complete in New South Wales.

Western Australia

There is one project currently underway in Western Australia:

- ‘Baseline seismic monitoring of the Canning Basin, WA’.

One project was completed during this reporting period:

- ‘Groundwater baseline study of the Canning Basin, Western Australia.’

Overall, two projects are now complete in Western Australia.

Queensland

The Queensland Research Advisory Committee met in May 2022, resulting in:

- Approval of socio economic project titled ‘CWB4: Trends in community wellbeing and attitudes to CSG development – Comparisons across industry phases from 2014 to 2024’. This project proposes to continue monitoring community wellbeing and attitudes to coal seam gas development in the Western Downs and eastern Maranoa regions in 2024, now that the CSG industry is in a fully operational phase.
- Approval of greenhouse gas footprint project titled ‘Methane contributions from holding ponds – a desktop study’. There are gaps in our understanding of the contribution of methane emissions from CSG water holding ponds and aquatic systems in Queensland. This project was developed to address those knowledge gaps, reduce uncertainty and collate existing data.
- Approval of surface and groundwater project titled ‘Cooper Creek flood modelling scenarios’. This project aims to deliver outputs from targeted flood modelling scenarios developed in response to on-going engagement with stakeholders in the Cooper GBA region. The outputs will include changes to flood risk and flood characteristics under future climate scenarios. They will also include flood characteristics resulting from any future gas industry developments, such as floodplain infrastructure, diversions or extraction activities.

In addition to the recently approved projects, there is one project currently underway in Queensland:

- ‘Potential health impacts from CSG’

Overall, 31 projects are now complete in Queensland.

South Australia

There are four projects currently underway in South Australia.

- ‘Perspectives on risk to local markets and industries’
- ‘Microbial degradation of chemicals and fluids in aquifers of the Limestone Coast, South Australia’
- ‘Decision support framework for future groundwater development scenarios in south east South Australia’
- ‘The role of gas in South Australia’

Overall, six projects are now complete in South Australia.

Project modifications and progress reporting

An approved research project consists of a Project Order and Budget that has been approved by the Research Advisory Committee.

During the execution of an approved project, changes and modifications to the Project Order and Budget may be submitted to the Director for consideration. The Director may approve minor modifications to Project Orders that do not significantly alter the proposed outcomes, and do not have significant financial consequences for the project. The Director may consult the Research Advisory Committee about these modifications.

Major modifications to Project Orders that may involve significant financial consequences or significant change in project scope will be prepared in consultation with the Director and presented to the Research Advisory Committee for approval. Any changes made to Project Orders are available for public perusal on CSIRO GISERA's website www.gisera.csiro.au.

Research updates and progress against project milestones are reported quarterly. Variations, if any, are also included as this allows any variations/modifications to the Project Order to be tracked easily. Summaries of each project's progress against milestones and variations, as well as the original Project Order, are available on the GISERA website: www.gisera.csiro.au/research/.

3 Consolidated Budget

This is the eleventh *GISERA Annual Research & Development Plan, Budget and Summary* and covers the financial year 2022-23.

The report objectives are to:

- Detail the contribution of each Partner to GISERA.
- Detail the contribution of government departments to GISERA.
- Include the committed research investment and expenditure for existing projects.
- Identify proposed research projects to be considered in the new financial year.

3.1 Consolidated Budget

3.1.1 Contributions and Grants

The committed financial contributions received from membership, in-kind, grants, funding agreements, APPEA and other industry contributions (separate from membership) over the life of GISERA is outlined in Table 3.1.

Table 3.1 Incoming contributions and grants, by contributor, 2011/12-2021/22

GROUP	PAYMENT TYPE	CONTRIBUTOR	TOTAL
Industry	Membership	Australia Pacific LNG	\$10,900,000
		QGC	\$1,750,000
		Santos	\$1,500,000
		AGL	\$287,500
		Origin Energy	\$1,050,000
		Pangaea Resources	\$150,000
	Contribution to project W11 (Air, water and soil impacts of hydraulic fracturing: Phase 1)	Australia Pacific LNG	\$245,670
	Contribution to project W12 (Air, water and soil impacts of hydraulic fracturing: Phase 2)	Australia Pacific LNG	\$1,285,000
Government	Contribution via APPEA to project GHG 1 (Methane Seepage in the Surat Basin)	Australia Pacific LNG, Santos, Arrow Energy & QGC	\$1,121,707
	Grant	Federal Government	\$18,887,000
		NSW Government	\$1,500,000
		SA Government	\$1,000,000
		QLD Government ²	\$500,000
		NT Government	\$950,000
	Contribution to project GHG 5 (Baseline measurement and monitoring of methane emissions in the Beetaloo Sub-basin)	NT Government	\$305,297
	In-kind contribution to project W25 (Baseline seismic monitoring of the Canning Basin)	Geological Survey of WA (GSWA)	\$1,154,800
CSIRO	In-kind contribution to project W25 (Baseline seismic monitoring of the Canning Basin)	Geoscience Australia (GA)	\$300,000
	In-kind	CSIRO	\$13,829,630
Other	In-kind contribution to project L5 (Without a Trace)	University of Southern Queensland (USQ)	\$79,990
	In-kind contribution to project W18 (Characterisation of the Stygofauna and microbial assemblages of the Beetaloo Sub-basin)	Charles Darwin University (CDU)	\$53,858
TOTAL			\$56,850,453

² QLD Government's grant to go towards the Health 2 project 'Potential health impacts from CSG'.

GISERA funding

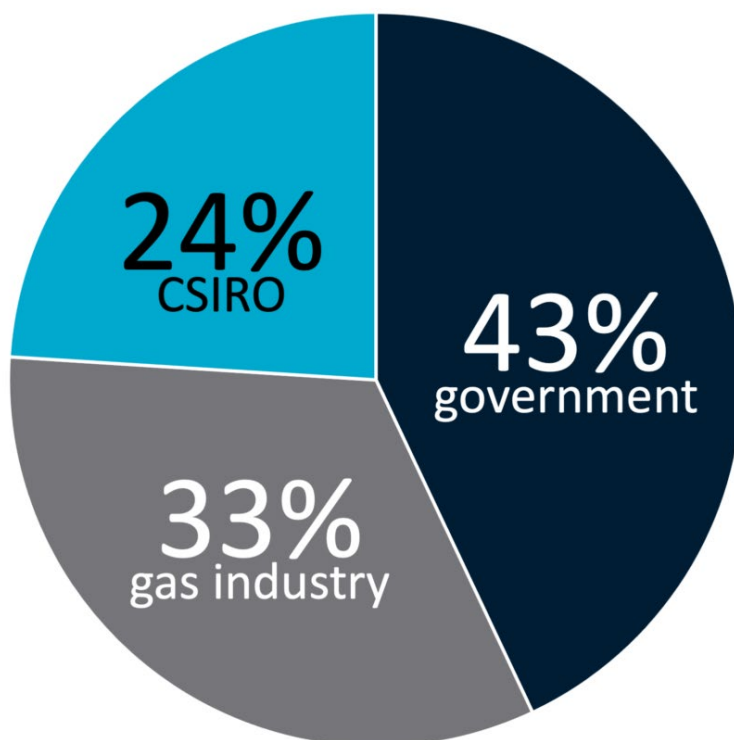


Figure 3 Committed contribution over life of GISERA, by group³

³ The 0.24% contribution from universities has been included in table 3.1, but not included in this pie chart.

3.1.2 Committed Research Investment

The committed budget for projects across all regions for 2011/12-2026/27 now stands at \$39,689,453. A breakdown of the committed research budget for the various research subject areas is provided in Table 3.2. Figure 4 shows the portion committed to each research subject area and Figure 5 shows the portion committed to each region.

Table 3.2 Committed research investment across all regions, by research subject area, 2011/12-2026/27

RESEARCH SUBJECT AREA	TOTAL RESEARCH INVESTMENT
Surface and groundwater	\$17,800,599
Social and economic	\$4,831,600 ⁴
Greenhouse gas footprint	\$4,709,391
Terrestrial and aquatic biodiversity	\$4,362,501
Agricultural land management	\$3,492,979
Land and infrastructure	\$3,095,436
Health	\$1,396,947
Total	\$39,689,453⁵

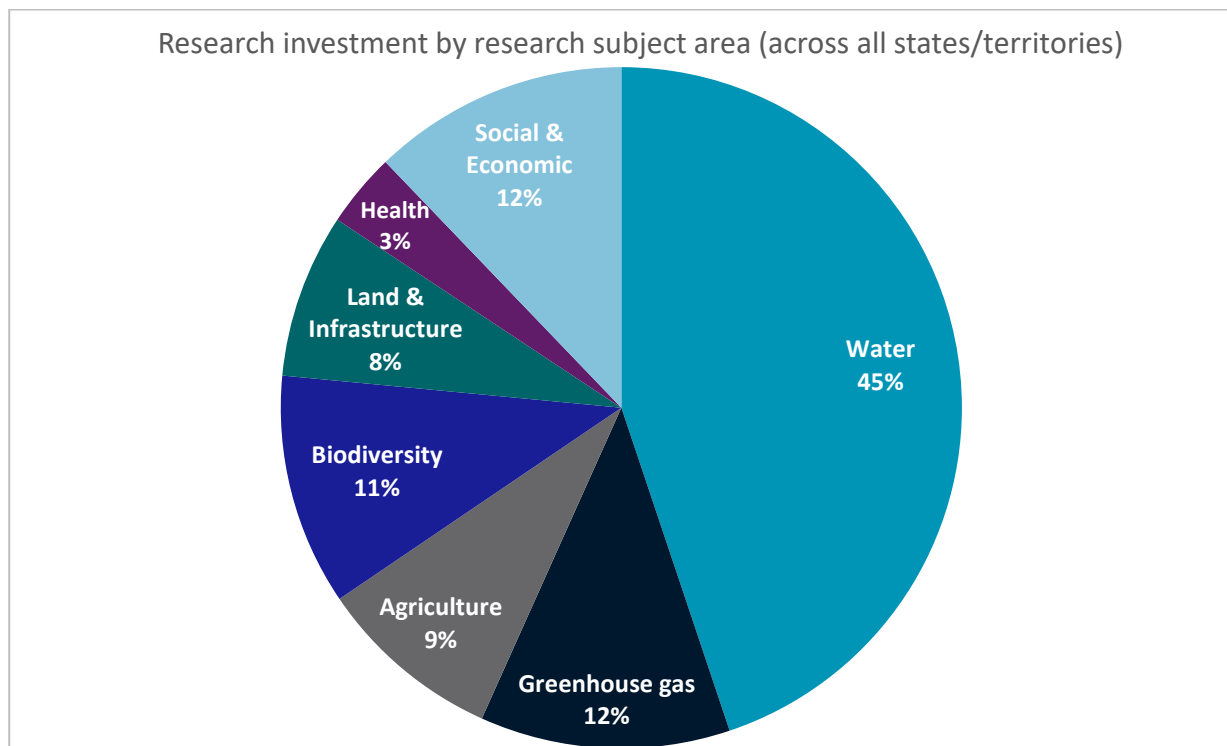


Figure 4 Committed research investment across all states/territories, by research subject area, 2011/12-2026/27

⁴ This includes \$289,388 allocated to a social and economic project 'Monitoring community wellbeing and attitudes to CSG development in Narrabri (construction phase)'. This research project is contingent on the construction phase of gas development in the Narrabri Shire commencing. If project does not proceed, funds will be returned for future reallocation.

⁵ These figures do not include funds for the GISERA Director's office and communications.

Table 3.3 Committed research investment across by state/territory, 2011/12-2026/27

STATE / TERRITORY	TOTAL RESEARCH INVESTMENT
Queensland	\$20,797,851
Northern Territory	\$7,755,887
New South Wales	\$6,156,980
South Australia	\$2,677,858
Western Australia	\$2,300,877
Total	\$39,689,453

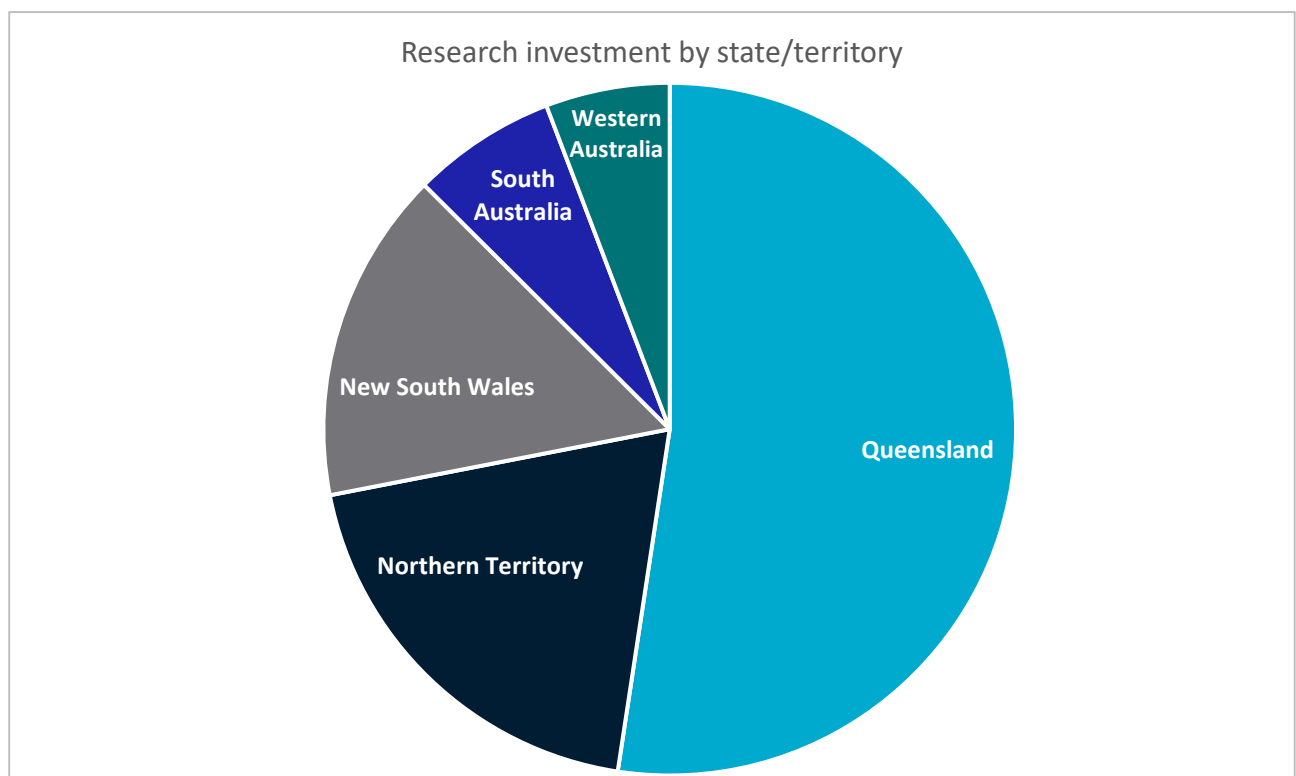


Figure 5 Committed research investment, by state/territory 2011/12-2026/27

3.2 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.

To learn more about GISERA projects by location, click on the [interactive map](#).

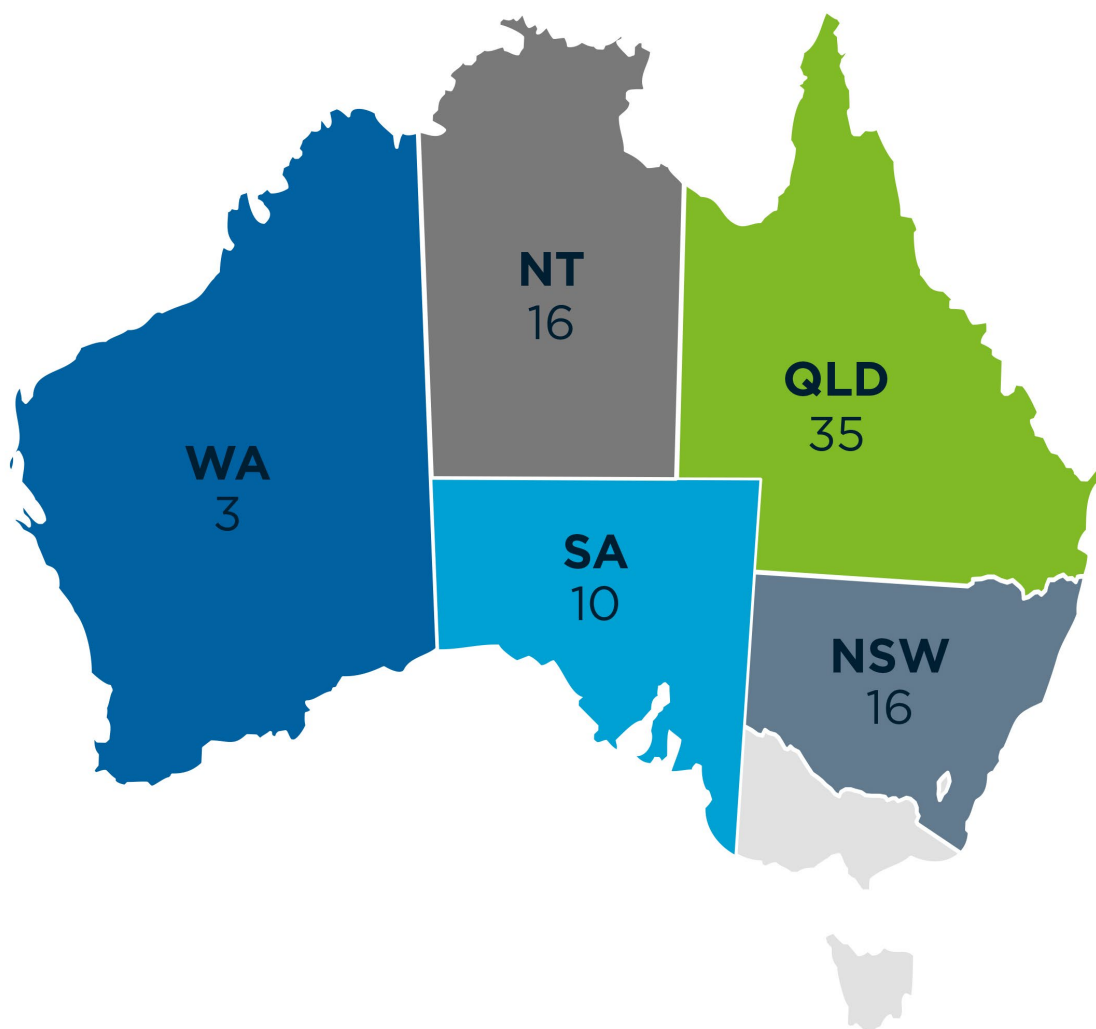


Figure 6 Number of research projects in each region

Table 3.4 Research projects across Australia currently underway or due to commence

RESEARCH AREA	PROJECT
Surface and groundwater	<ul style="list-style-type: none"> • Microbial degradation of chemicals and fluids in aquifers of the Limestone Coast (SA) • Decision support framework for future groundwater (SA) development scenarios in the southeast (SA) • Onshore gas water lifecycle management options framework (NT) • Fate of hydraulic fluids/chemicals and geogenic hydrocarbons in surface facilities and in the subsurface (NT) • Microbial communities and their ability to degrade prospective chemicals used in coal seam gas activities (NSW) • Geochemical modelling and geophysical surveys to refine understanding of connectivity between coal seams and aquifers (NSW) • Groundwater modelling and predictive analysis to inform CSG impact assessment, monitoring and management (NSW) • Cooper Creek flood modelling scenarios (QLD) • Examination of stygofauna ecosystems of the Beetaloo Sub-basin (NT)
Social and economic	<ul style="list-style-type: none"> • Monitoring community wellbeing and attitudes to CSG in Narrabri (pre-construction phase) (NSW) • Monitoring community wellbeing and attitudes to CSG in Narrabri (construction phase) (NSW) • The Role of Gas in South Australia (SA) • Trends in community wellbeing and attitudes to CSG development – Comparisons across industry phases from 2014 to 2024 (QLD)
Greenhouse gas and air quality	<ul style="list-style-type: none"> • Offsets for Life cycle Greenhouse Gas Emissions of Onshore gas (NT) • Methane emissions quantification of well drilling to completion processes in Beetaloo Sub-basin (NT) • Methane contributions from holding ponds – a desktop study (QLD)
Terrestrial and aquatic biodiversity	<ul style="list-style-type: none"> • Understanding and managing impacts to biodiversity from roads and pipelines in the Beetaloo (NT)
Agricultural land management	<ul style="list-style-type: none"> • Perspectives on risk to local markets and industries (SA) • Putting land management knowledge into practice (NT)
Health impacts	<ul style="list-style-type: none"> • Potential human health impacts from CSG activities (QLD)
Land and infrastructure	<ul style="list-style-type: none"> • Baseline seismic monitoring of the Canning Basin (WA) • Background Seismicity of Beetaloo Sub-Basin and Seismic Hazard (NT) • Beetaloo basin shale long-term competency after decommissioning (NT)

Details on already completed projects can be found below in each of the state and territory sections.

4 Queensland R&D Plan & Budget

4.1 Queensland Investment profile

4.1.1 Committed research investment for 2011/12-2024/25

The committed budget for projects in Queensland for 2011/12-2024/25 now stands at \$20,797,851. A breakdown of the committed research budget across the various research subject areas is provided in Table 4.1 and Table 4.2 shows the investment committed by contributor.

Table 4.1 Committed research investment in Queensland by research subject area, 2011/12-2024/25

TOPIC	TOTAL RESEARCH INVESTMENT
Surface and groundwater (37%)	\$7,607,264
Terrestrial and aquatic biodiversity (19%)	\$3,991,757
Greenhouse gas (14%)	\$2,936,752
Agriculture (14%)	\$2,809,166
Social & economic (11%)	\$2,328,489
Health (5%)	\$1,124,423
Total	\$20,797,851

Table 4.2 Committed research investment in Queensland by contributor, 2011/12-2024/25

CONTRIBUTOR	CONTRIBUTION TYPE	TOTAL RESEARCH CONTRIBUTION
CSIRO (29.2%)	In-kind	\$6,072,477
USQ (0.4%)	In-kind contribution to project L5 (Without a Trace)	\$79,990
Australia Pacific LNG (52%)	GISERA Membership	\$9,001,695
	Contribution via APPEA to project GHG 1 (Methane Seepage in the Surat Basin)	\$280,427
	Contribution to project W11 (Air, water and soil impacts of HF: Phase 1)	\$245,670
	Contribution to project W12 (Air, water and soil impacts of HF: Phase 2)	\$1,285,000
QGC (7.9%)	GISERA Membership	\$1,362,396
	Contribution via APPEA to project GHG 1 (Methane Seepage in Surat Basin)	\$280,427
Santos (1.3%)	Contribution via APPEA to project GHG 1 (Methane Seepage in Surat Basin)	\$280,427
Arrow Energy (1.3%)	Contribution via APPEA to project GHG 1 (Methane Seepage in Surat Basin)	\$280,427
Federal Govt (5.5%)	Grant	\$1,128,916
Qld Govt (2.4%)	Grant	\$500,000
Total		\$20,797,851

4.1.2 Queensland Current Research Portfolio

A summary of all approved research projects in Queensland is provided in table 4.3

Table 4.3 Approved Queensland Research Projects

RESEACH AREA	PROJECT	STATUS
Surface and Groundwater	Geochemical responses to re injection - understand and quantify aquifer reactions occurring due to re-injection of CSG water, and their impacts on water quality.	Completed
	Re-injection of CSG water - understand, quantify and manage clogging of injection wells during re-injection of CSG water permeates, brines and blends.	Completed
	High performance groundwater modelling - determine the feasibility of large scale re-injection schemes.	Completed
	Isotope and geochemical groundwater baseline study - characterise the baseline geochemistry of groundwater and formation water prior to and during initial stages of development to understand groundwater age and origin.	Completed
	Hydrocarbons in groundwater, Surat and Bowen basins - 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.	Completed
	Constraining water flows in the Surat Basin - measuring and modelling specific chemicals called environmental tracers to gain a better understanding of the speed and direction of groundwater flow.	Completed
	Groundwater contamination risk assessment - assess the likelihood of groundwater contamination from hydraulic fracturing and wellbore damage.	Completed
	Air, water and soil impacts of hydraulic fracturing (Phase 1) - 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.	Completed
	Air, water and soil impacts of hydraulic fracturing (Phase 2) - undertake 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.	Completed
	Cooper Creek flood modelling scenarios - to deliver outputs from targeted flood modelling scenarios developed in response to on-going engagement with stakeholders in the Cooper GBA region	Underway
Social and Economic	Monitoring regional transition - 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.	Completed
	Community functioning and well-being - 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.	Completed

RESEACH AREA	PROJECT	STATUS
	Economic assessment and forecasting project -understand future impacts on regional economies and how local businesses can respond.	Completed
	Understanding community aspirations - 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.	Completed
	Community function and well-being survey 2 - 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.	Completed
	Trends in community wellbeing and attitudes to CSG development – Survey 3 - monitoring and communicating the changes and trends in community wellbeing, resilience and attitudes to CSG development across different phases of industry operation in south west Queensland, and identifies how these vary between the construction, post-construction, and operations phases of development.	Completed
	Community wellbeing and attitudes to CSG development - 2014 to 2024 – Survey 4 - Identifying trends in community wellbeing and attitudes to CSG development in south-west Queensland - from the construction phase to a fully operational phase.	To commence in 22/23
Greenhouse Gas Footprint	Methane seepage in the Surat Basin - 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.	Completed
	Greenhouse gas emission assessment of the Surat Basin Gas Reserve - analysis of the whole of life cycle GHG emissions, including extraction, transportation and usage of CSG in the Surat Basin.	Completed
	Ambient air quality in the Surat Basin - comprehensive assessment of air quality in the Surat Basin region in Queensland using air quality measurement network and modelling.	Completed
	Methane contributions from holding ponds - A desktop study to identify emissions potential and controls in CSG holding ponds and aquatic systems in Queensland	To commence in 22/23
Agricultural Land Management	Preserving agricultural productivity - assist in the preservation of agricultural productivity during land use change.	Completed
	Shared space - understand how farmers from a range of production systems (extensive grazing to intensive cropping) perceive and value CSG developments on their and others' farms.	Completed
	Gas farm design - understand how to design farms for a new mixed land use.	Completed
	Making tracks, treading carefully - understand the direct and indirect impacts of tracks and traffic on invasive species and erosion in agricultural landscapes.	Completed

RESEACH AREA	PROJECT	STATUS
	Without a trace - identify the nature and likely extent of damage to agricultural soils, and methods for avoiding and improving soils.	Completed
	Telling the story - Share understanding of changes on farms and in towns during CSG development in the Surat area.	Completed
	CSG and Livestock – Inside the Herd - monitoring grazing land with CSG infrastructure to better understand the impacts of CSG infrastructure, traffic and dust on animals and pastures.	Completed
Terrestrial and Aquatic Biodiversity	Priority threat identification, management and appraisal - identify and understand the broad range of existing and new threats to biodiversity across a CSG development region.	Completed
	Fire ecology of grassy woodlands - 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.	Completed
	Habitat selection by two focal species - 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.	Completed
	Ensuring biodiversity offset success: the right kind of seed for a rare daisy - Identify genetic and demographic factors that may limit the success of establishing a rare daisy (<i>Rutidosia lantana</i>) in a new location.	Completed
	Guidelines for offset population sizes - 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.	Completed
	Sustaining turtles and their homes - understand how sediments from dredging and discharges affect seagrass and turtles.	Completed
Health	Potential health impacts from CSG - establish processes and governance to ensure research quality, define the project boundary, conduct hazard identification and exposure pathways, and screen data.	Near completion

4.1.3 Queensland Research Progress and Expenditure

The committed Queensland research budget, expenditure and milestones completed for each project is provided in table 4.4 (* = completed projects).

Table 4.4 Committed research investment, expenditure and progress in Queensland, by project

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ⁶	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
Surface and groundwater	Geochemical responses to re-injection*	\$1,061,242	\$1,126,356	106%	100%
	Re-injection of CSG water*	\$1,039,989	\$1,085,085	104%	100%
	High performance groundwater modelling*	\$928,215	\$1,024,173	110%	100%
	Isotope and geochemical groundwater baseline study*	\$667,053	\$709,848	106%	100%
	Hydrocarbons in groundwater, Surat & Bowen basins*	\$257,694	\$568,722	221%	100%
	Constraining groundwater flow models*	\$588,957	\$732,651	124%	100%
	Water contamination risk assessment on hydraulic fracturing in unconventional gas extraction*	\$290,624 ⁷	\$293,542	101%	100%
	Air, water and soil impacts of hydraulic fracturing (Phase 1)*	\$330,795 ⁸	\$351,433	106%	100%
	Air, water and soil impacts of hydraulic fracturing (Phase 2)*	\$2,111,055 ⁹	\$2,153,095	102%	100%
	Cooper Creek flood modelling scenarios	\$520,544	\$3,855	1%	0%
Social and economic	Monitoring regional transition*	\$376,088	\$404,084	107%	100%
	Community functioning and well-being*	\$417,438	\$457,314	110%	100%
	Economic assessment and forecasting project*	\$296,508	\$299,971	101%	100%
	Understanding community aspirations*	\$342,692	\$341,821	100%	100%
	Community function and well-being survey 2*	\$180,479	\$190,269	105%	100%

⁶ Any expenditure exceeding 100% represents an additional CSIRO contribution.

⁷ This is a jointly funded QLD and NSW project. The figures presented in this table are for 'total project costs' and not split by region.

⁸ This includes \$245,670 contribution from APLNG (separate from membership).

⁹ This includes \$1,285,000 contribution from APLNG (separate from membership).

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ⁶	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
	Trends in community wellbeing and attitudes to CSG development - survey 3*	\$240,474	\$243,795	101%	100%
	Community wellbeing and attitudes to CSG development – 2014 to 2024	\$474,810	\$0 ¹⁰	0%	0%
Greenhouse gas footprint	Methane seepage in Surat Basin*	\$2,015,937 ¹¹	\$2,293,692	114%	100%
	Greenhouse gas (GHG) emission assessment of the Surat Basin Gas Reserve*	\$241,708	\$318,256	132%	100%
	Ambient air quality in the Surat Basin*	\$541,771	\$605,517	112%	100%
	Methane contributions from holding ponds	\$137,337	\$0 ¹²	0%	0%
Agricultural land management	Preserving agricultural productivity*	\$547,756	\$538,532	98%	100%
	Shared space*	\$140,445	\$138,805	99%	100%
	Gas farm design*	\$651,329	\$626,057	96%	100%
	Making tracks, treading carefully*	\$564,089	\$578,197	103%	100%
	Without a trace*	\$339,990 ¹³	\$339,990	100%	100%
	Telling the story*	\$332,224	\$329,234	99%	100%
	CSG & Livestock- Inside the herd*	\$233,333	\$239,628	103%	100%
Terrestrial and aquatic biodiversity	Priority threat identification, management and appraisal*	\$945,400	\$995,144	105%	100%
	Fire ecology of grassy woodlands*	\$789,042	\$840,016	106%	100%
	Habitat selection by two focal species*	\$167,432	\$204,990	122%	100%
	Ensuring biodiversity offset success: the right kind of seed for a rare daisy*	\$198,055	\$225,232	114%	100%
	Guidelines for offset population sizes*	\$198,630	\$200,326	101%	100%
	Sustaining turtles and their homes*	\$1,693,199	\$1,802,905	106%	100%
Health	Potential health impacts from CSG	\$1,124,423	\$1,041,612	93%	67%
TOTAL ALLOCATED BUDGET		\$20,797,851			

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

¹⁰ This is a newly approved project. Expenditure will be incurred in 2022/23.

¹¹ This includes \$1,121,707 combined contribution from APLNG, QGC, Santos and Arrow (separate from membership).

¹² This is a newly approved project. Expenditure will be incurred in 2022/23.

¹³ This includes \$79,990 in-kind contribution from USQ.

4.2 Queensland research ideas being discussed for 2022/23

The following project ideas are being discussed but are yet to be ratified and are subject to review by the relevant Research Advisory Committee. Over coming months further stakeholder consultation will occur aiming to prioritise these research ideas in relation to other community issues.

Table 4.5 Future research ideas in Queensland for 2022/23

RESEARCH AREA	IDEA	BASIN	ESTIMATED COST
Health	The GISERA Health 2 project 'Potential human health effects from CSG' identified and appraised over 110 unique chemical factors from over 150 drilling or hydraulic fracturing additives. A small number of chemicals were identified as warranting further investigation to determine whether they persist in the environment in a way that allows human exposure. This project would progress further assessment of these chemicals should that be warranted once the 'Health 2 Project' is completed.	Surat	\$500-\$600k
Health	Following GISERA Health project 2, identified dust as an issue warranting further investigation. While previous GISERA Air Quality research has shown dust levels to be within accepted health and environmental guidelines in the Surat Basin, the presence of dust is a well-known fact of life in rural areas. This project would potentially assess how CSG activities may change the composition and amount of dust in the study area and the implications for those living in the region.	Surat	\$500-\$600k
Social and Economic Impacts	Evaluating medium term socio-economic impacts of onshore gas activity in Southern Queensland - this project would inform and support change arising from CSG developments to enhance regional and community benefit, and to provide a legacy of knowledge that enables communities in this and other regions to potentially benefit from future resource developments. The opportunity to compare the impacts over decades will provide unprecedented assessment of changes in these regional economies following an initial boom, to inform the development of future resource industries.	Surat	\$250-350k
Greenhouse Gases and Air Quality	An existing GISERA project 'Methane contributions from holding ponds – a desktop study' will identify knowledge gaps, collate existing company data and develop a field survey program that will reduce uncertainty of the potential contributions to emissions from water holding ponds. If the current project identifies the potential for quantitatively significant volumes of GHGs to be generated, the outcomes of the current project will be used to design future data collection approaches and a preferred methodology for accurately quantifying methane emissions for water holding ponds in Queensland. This will ensure complete coverage of all aspects of natural gas production for fugitive emissions in the National Greenhouse Gas Inventory and will contribute to enhanced community understanding of the level of risk to potential climate impacts from natural gas production in Queensland.	Multiple	\$1.2M

RESEARCH AREA	IDEA	BASIN	ESTIMATED COST
Greenhouse Gases and Air Quality	This project would investigate the potential for gas emissions from legacy coal exploration boreholes (for mining) in regions of coal seam gas.	Surat	\$350k
Land and Infrastructure	This project would assist in understanding the performance of cement used in well completion and its impacts on long term well integrity in the Surat and Bowen Basins in Queensland.	Multiple	\$150K

5 NSW R&D Plan & Budget

5.1 NSW Investment profile

5.1.1 Committed research investment for 2016/17-2026/27

The committed budget for projects in New South Wales for 2016/17-2026/27 now stands at \$6,156,980. A breakdown of the committed research budget across the various research subject areas is provided in Table 5.1 and Table 5.2 shows the investment committed by contributor.

Table 5.1 Committed research investment in NSW by research subject area, 2016/17-2026/27

RESEARCH AREA	TOTAL RESEARCH INVESTMENT
Water (68%)	\$4,179,600
Social & economic (25%)	\$1,549,493
Health (4%)	\$272,524
Greenhouse gas (3%)	\$155,363
TOTAL	\$6,156,980

Table 5.2 Committed research investment in NSW by contributor, 2016/17-2026/27

CONTRIBUTOR	CONTRIBUTION TYPE	TOTAL RESEARCH CONTRIBUTION
Federal Government (55%)	Grant	\$3,396,848
NSW Government (15%)	Grant	\$908,142
CSIRO (22%)	In-kind	\$1,349,873
Santos (4.5%)	GISERA Membership	\$280,980
AGL (3.5%)	GISERA Membership	\$221,137
TOTAL		\$6,156,980

5.1.2 NSW Current Research Portfolio

A summary of all approved research projects in NSW is provided in table 5.3

Table 5.3 Approved NSW Research Projects

RESEACH AREA	PROJECT	STATUS
Surface and Groundwater	Impacts of CSG depressurization on Great Artesian Basin flux - improve the understanding of the GAB groundwater flow in the Pilliga region through integration of existing information from models, hydrochemical data and environmental tracers.	Completed
	Spatial design of groundwater monitoring network in the Narrabri Gas Project area - analysis and design of groundwater bore networks for optimal groundwater monitoring and early detection of changes.	Completed
	Improving groundwater models to better represent coal seam gas extraction impacts in the Namoi region - develop more representative models for estimating the groundwater impacts from coal seam gas well fields.	Completed
	Groundwater contamination risk assessment - Assess the likelihood of groundwater contamination from hydraulic fracturing and wellbore damage.	Completed
	Assessment of faults as potential connectivity pathways - improve 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 by helping to further improve the accuracy of future groundwater models in the Narrabri region.	Completed
	Microbial communities and their ability to degrade prospective chemicals used in coal seam gas activities - this research will help improve understanding of the fate of chemical compounds used in coal seam gas (CSG) activities in the region if these compounds were to come into contact with the environment.	To commence in 22/23
	Geochemical modelling and geophysical surveys to refine understanding of connectivity between coal seams and aquifers - this project will further improve our knowledge of groundwater systems in the Gunnedah and Surat Basins in the Narrabri region and refine the conceptual understanding of potential for hydrogeological connectivity pathways between shallow aquifers.	To commence in 22/23
	Groundwater modelling and predictive analysis to inform CSG impact assessment, monitoring and management - this project will undertake independent groundwater modelling and predictive analyses to inform coal seam gas groundwater impact assessment and regulatory monitoring and management in the Narrabri Gas Project area.	To commence in 22/23
Social and Economic	Analysing economic and demographic trajectories in NSW regions experiencing CSG development and operations - 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.	Completed

RESEACH AREA	PROJECT	STATUS
	Social baseline assessment of the Narrabri region of NSW in relation to CSG development - 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.	Completed
	Decommissioning pathways for CSG projects - 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.	Completed
	Assessing and projecting on-shore gas effects on regional economic activity - this project will analyse the influence of the NSW on-shore gas industry on regional economic and social indicators, and use economic models to generate descriptions of potential future effects for NSW.	Completed
	Monitoring community wellbeing and attitudes to CSG in Narrabri (pre-construction phase) - this project will 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.	Underway
	<u>Monitoring community wellbeing and attitudes to CSG in Narrabri (construction phase)</u> ¹⁴ - this project will monitor any changes in local community wellbeing and attitudes to coal seam gas (CSG) during the construction phase of the Santos Narrabri Gas Project in NSW.	To commence in 24/25
Greenhouse Gas Footprint	Regional Methane Emissions in NSW CSG Basins - this project will identify and quantify methane emission sources such as CSG infrastructure, feedlots, coal mining, legacy bore holes in the Pilliga region.	Completed
Health	Potential human health effects of coal seam gas (study framework) - 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.	Completed

¹⁴ This research project is contingent on the construction phase of gas development in the Narrabri Shire commencing.

5.1.3 NSW Research Progress and Expenditure

The committed New South Wales research budget, expenditure and milestones completed for each project is provided in table 5.4 (* = completed projects).

Table 5.4 Committed research investment, expenditure and progress in NSW, by project

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ¹⁵	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
Surface and groundwater	Impacts of CSG depressurisation on the Great Artesian Basin flux*	\$429,859	\$429,859	100%	100%
	Data- worth analysis and spatial design of groundwater monitoring networks in the Narrabri Gas Project area*	\$216,218	\$217,613	101%	100%
	Improving groundwater models to better represent coal seam gas extraction impacts in the Namoi region*	\$301,295	\$301,834	100%	100%
	Water contamination risk assessment on hydraulic fracturing in unconventional gas extraction*	\$290,624 ¹⁶	\$293,542	101%	100%
	Assessment of faults as potential connectivity pathways*	\$234,930	\$235,462	100%	100%
	Microbial communities and their ability to degrade prospective chemicals used in coal seam gas activities	\$560,709	\$0 ¹⁷	0%	0%
	Geochemical modelling and geophysical surveys to refine understanding of connectivity between coal seams and aquifers	\$1,053,298	\$0 ¹⁸	0%	0%
	Groundwater modelling and predictive analysis to inform CSG impact assessment, monitoring and management	\$1,194,385	\$0 ¹⁹	0%	0%
Social and economic	Analysing economic and demographic trajectories in NSW regions experiencing CSG development and operations*	\$103,694	\$103,694	100%	100%

¹⁵ Any expenditure exceeding 100% represents an additional CSIRO contribution.

¹⁶ This is a jointly funded QLD and NSW project. The figures presented in this table are for 'total project' and not split by region.

¹⁷ This is a newly approved project. Expenditure will be incurred in 2022/23.

¹⁸ This is a newly approved project. Expenditure will be incurred in 2022/23.

¹⁹ This is a newly approved project. Expenditure will be incurred in 2022/23.

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ¹⁵	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
	Social baseline assessment of the Narrabri region of NSW in relation to CSG development*	\$272,292	\$320,467	118%	100%
	Decommissioning CSG Wells*	\$298,876	\$299,012	100%	100%
	Assessing and projecting onshore gas effects on regional economic activity*	\$258,883	\$258,882	100%	100%
	Monitoring community wellbeing and attitudes to CSG in Narrabri (pre-construction phase)	\$326,360	\$33,643	10%	0%
	Monitoring community wellbeing and attitudes to CSG in Narrabri (construction phase)	\$289,388 ²⁰	\$0	0%	0%
Greenhouse gas footprint	Regional methane emissions in NSW CSG basins*	\$155,363	\$155,363	100%	100%
Health	Human Health effects of Coal Seam Gas Activity Study Design*	\$272,524	\$317,002	116%	100%
TOTAL ALLOCATED BUDGET		\$6,156,980			

²⁰ This research project is contingent on the construction phase of gas development in the Narrabri Shire commencing. If project does not proceed, funds will be returned for future reallocation.

5.2 NSW research ideas being discussed for 2022/23

The following project ideas are being discussed but are yet to be ratified and are subject to review by the relevant Research Advisory Committee. Over coming months further stakeholder consultation will occur aiming to prioritise these research ideas in relation to other community issues.

Table 5.5 Future research ideas in NSW for 2022/23

RESEARCH AREA	IDEA	BASIN	ESTIMATED COST
Land and Infrastructure	A unique opportunity may exist to study the legacy of a CSG development at final stages of decommissioning in Camden.	Camden	\$250-400K
Biodiversity	A study that would quantify the level of fragmentation across landscapes with differing land uses in the Pilliga Forest, assess how fragmentation might influence the occupancy of sites by key threatened species, predict the contribution of the Narrabri gas project to potential cumulative impacts from fragmentation in the region, and develop a framework for remote monitoring of fragmentation in the Narrabri gas footprint.	Gunnedah	\$500-650k
Surface and Groundwater	Scoping study on potential options for the beneficial reuse and disposal of produced coal seam gas water and brine stored at the Leewood Water Treatment Facility, Narrabri	Gunnedah	\$250-350K

6 South Australia R&D Plan & Budget

6.1 South Australia Investment profile

6.1.1 Committed research investment for 2018/19 - 2022/23

The committed budget for projects in South Australia for 2018/19-2022/23 now stands at \$2,677,858. A breakdown of the committed research budget across the various research subject areas is provided in Table 6.1 and Table 6.2 shows the investment committed by contributor.

Table 6.1 Committed research investment in South Australia by research subject area, 2018/19-2022/23

RESEARCH AREA	TOTAL RESEARCH INVESTMENT
Water (55%)	\$1,484,564
Social & economic (29%)	\$759,310
Agriculture (16%)	\$433,984
Total	\$2,677,858

Table 6.2 Committed research investment in South Australia by contributor, 2018/19-2022/23

CONTRIBUTOR	CONTRIBUTION TYPE	TOTAL RESEARCH CONTRIBUTION
Federal Government (46%)	Grant	\$1,225,787
SA Government (29%)	Grant	\$782,606
CSIRO (25%)	In-kind	\$669,465
Total		\$2,677,858

6.1.2 South Australia Current Research Portfolio

A summary of all approved research projects in South Australia is provided in table 6.3.

Table 6.3 Approved South Australia Research Projects

RESEACH AREA	PROJECT	STATUS
Surface and Groundwater	Onshore gas and water contamination: causes, pathways and risks - investigate potential groundwater contamination causes, pathways and vulnerability to understand onshore gas water quality impacts for southeast SA.	Completed
	Groundwater balance in gas development regions of South East South Australia - improve groundwater balance models in the onshore gas development regions of south east South Australia.	Completed
	Microbial degradation of chemical compounds used in onshore gas production in the SE of South Australia - understand the biodegradation of certain chemical compounds used in onshore gas production in the south-east of South Australia.	Completed
	Microbial degradation of chemicals and fluids in aquifers of the Limestone Coast, SA - demonstrate the potential for microbial degradation of chemicals used by the onshore gas industry across the Tertiary Limestone Aquifer (TLA) in the Limestone Coast region of south east South Australia.	Near completion
	Decision support framework for future groundwater development scenarios in the southeast SA - develop and test a decision support framework to improve management of groundwater resources. Research outcomes will consider probable future groundwater use scenarios, taking account of climate change and various future water use patterns for irrigation, forestry, onshore gas and other industries in the south east of South Australia.	Near completion
Social and Economic	Community wellbeing and attitudes to conventional gas development in the South East of South Australia - measure levels of perceived risk, benefits, knowledge, and other underlying drivers of trust and social acceptance of conventional gas development in South Australia's south east, and develop baseline data on community values, well-being and future expectations.	Completed
	Assessing the value of locally produced conventional gas in SA's South East - develop a profile of the gas industry and its role within the regional economy and develop scenarios for how the local gas industry may evolve.	Completed
	The role of gas in South Australia - clarify the role of natural gas in meeting the state's renewable energy, security, emissions and energy pricing goals.	Near completion
Agricultural Land Management	Gas impacts and opportunities on primary industries - analyse possible impacts and opportunities from gas development for rural areas in South Australia's south east.	Completed
	Perspectives on risk to local markets and industries - 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 SA.	Near completion

6.1.3 South Australia Research Progress and Expenditure

The committed South Australia research budget, expenditure and milestones completed for each project is provided in table 6.4. (* = completed projects).

Table 6.4 Committed research investment, expenditure and progress in South Australia, by project

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ²¹	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
Surface and Groundwater	Onshore gas and water contamination: causes, pathways and risks*	\$277,550	\$280,170	101%	100%
	Groundwater balance in gas development regions of south east South Australia*	\$326,036	\$327,997	101%	100%
	Microbial degradation of chemical compounds used in onshore gas production in the south east of South Australia*	\$240,604	\$244,834	102%	100%
	Microbial degradation of chemicals and fluids in aquifers of the Limestone Coast, South Australia	\$273,502	\$248,093	91%	57%
	Decision support framework for future groundwater development scenarios in the southeast South Australia	\$366,872	\$332,677	91%	71%
Social and Economic	Community wellbeing and attitudes to conventional gas development in the south east of South Australia*	\$198,500	\$197,830	100%	100%
	Assessing the value of locally produced conventional gas in SA's South East*	\$238,480	\$238,667	100%	100%
	The role of gas in South Australia	\$322,330	\$260,169	81%	50%
Agricultural land management	Gas impacts and opportunities on primary industries*	\$175,133	\$178,089	102%	100%
	Perspectives on risk to local markets and industries	\$258,851	\$251,138	97%	60%
TOTAL ALLOCATED BUDGET		\$2,677,858			

²¹ Any expenditure exceeding 100% represents an additional CSIRO contribution.

6.2 South Australia research ideas being discussed for 2022/23

The following project ideas are being discussed but are yet to be ratified and are subject to review by the relevant Research Advisory Committee. Over coming months further stakeholder consultation will occur aiming to prioritise these research ideas in relation to other community issues.

Table 6.5 Future research ideas in South Australia for 2022/23

SUBJECT AREA	IDEA	BASIN	ESTIMATED COST
Land and Infrastructure	The potential for increased seismic activity associated with subsurface activities is an increasing area of community concern. Building on experience in other locations a baseline study would allow the future detection of any potential increase in seismic activity arising from new exploration and operational activity in the western side of the Otway Basin using passive seismic arrays and near real time reporting of location and magnitudes of events. Types of monitoring equipment will be evaluated and compared with some of the existing Geoscience Australia national network.	Otway	\$400-500K
Social and Economic Impacts	In 2020, a community wellbeing project was completed in south east South Australia. The survey addressed community attitudes towards conventional gas development and their future expectations. The results presented a broad spectrum of attitudes towards conventional gas development. A follow-up community wellbeing study is proposed that would capture any evolution in attitudes to natural gas development following COVID isolations, east coast gas impacts, and firming up of emissions targets at a national level.	Otway Basin	\$250-350k

7 Northern Territory R&D Plan & Budget

7.1 Northern Territory Investment profile

7.1.1 Committed research investment for 2018/19 - 2024/25

The committed budget for projects in Northern Territory for 2018/19-2024/25 now stands at \$7,755,887. A breakdown of the committed research budget across the various research subject areas is provided in Table 7.1 and Table 7.2 shows the investment committed by contributor.

Table 7.1 Committed research investment in Northern Territory by research subject area, 2018/19-2024/25

RESEARCH AREA	TOTAL RESEARCH INVESTMENT
Surface and Groundwater (57%)	\$4,429,896
Greenhouse Gas Footprint (21%)	\$1,617,276
Land and Infrastructure (12%)	\$945,058
Biodiversity (4%)	\$319,520
Agriculture (3%)	\$249,829
Social & economic (3%)	\$194,308
Total	\$7,755,887

Table 7.2 Committed research investment in Northern Territory by contributor, 2018/19-2024/25

CONTRIBUTOR	CONTRIBUTION TYPE	TOTAL RESEARCH CONTRIBUTION
CSIRO (21%)	In-kind	\$1,638,227
Federal Government (52%)	Grant	\$4,025,331
NT Government (11%)	Grant	\$865,375
Santos (7%)	GISERA membership	\$551,471
Origin (6%)	GISERA membership	\$498,187
Pangaea (2%)	GISERA membership	\$123,438
Charles Darwin University (1%)	In-kind contribution to project W18 (Characterisation of the Stygofauna and microbial assemblages of the Beetaloo Sub-basin)	\$53,858
Total		\$7,755,887

7.1.2 Northern Territory Current Research Portfolio

A summary of all approved research projects in Northern Territory is provided in table 7.3.

Table 7.3 Approved Northern Territory Research Projects

RESEACH AREA	PROJECT	STATUS
Surface and Groundwater	Baseline monitoring of groundwater properties in the Beetaloo Sub-basin, NT - understand the geochemical properties, recharge rates and recharge mechanisms of groundwater.	Completed
	Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids - better understand how typical onshore gas chemicals biodegrade in relevant aquifers and soil types in the Northern Territory.	Completed
	Improved approaches to long-term monitoring of decommissioned onshore gas wells - investigate options for long-term monitoring of well integrity in decommissioned onshore gas wells in the Northern Territory, including assessment of well decommissioning practices and monitoring techniques and technology, in the context of Northern Territory regulatory requirements	Completed
	Onshore gas water lifecycle management options framework - design an options framework and decision criteria for water and wastewater management for Northern Territory onshore gas development.	Near completion
	Fate of hydraulic fracturing fluids/chemicals and geogenic hydrocarbons in surface facilities and in the subsurface - provide a systems-based approach to understanding chemicals and their lifecycle during hydraulic fracturing, in flow-back water produced after fracturing, and in tanks and ponds in industry facilities in the Northern Territory.	Underway
	Characterisation of the stygofauna and microbial assemblages of the Beetaloo Sub-basin, NT - To undertake a broad spatial pilot-scale survey of water bores in the Beetaloo Sub-basin, using direct sampling and DNA-based approaches to determine the distribution and abundance of stygofauna and characterise subterranean groundwater-dependent ecosystems.	Completed
	Examination of stygofauna ecosystems of the Beetaloo Sub-basin - this research aims to build an understanding of the extent to which stygofauna present in bores reflect their presence more widely within aquifers. It also aims to understand the physical and chemical drivers that may determine where stygofauna exist and how communities may be connected.	To commence in 2022/23
Social and Economic	Mapping future transport passages and volumes for improved planning and operation - Using scenarios of both construction and operational phases of gas development, this project will analyse road and rail freight costs, flows and impacts for identified sites and regions in the Beetaloo Sub-basin in the Northern Territory. It will also test a range of interventions that may increase road safety while reducing costs and impacts on the environment and local communities.	Completed

RESEACH AREA	PROJECT	STATUS
Greenhouse Gas Footprint	Baseline measurement and monitoring of methane emissions in the Beetaloo Sub-basin - Understanding of the natural methane levels, over the various seasons, a baseline for accurately quantifying any future onshore gas impacts.	Completed
	Mitigating Fugitive Gas Emissions from Well Casings - review current industry practice and conduct experimental investigations to evaluate techniques and assess new materials designed to minimise fugitive methane emissions leaking from microfractures and gaps in gas well cement casing	Completed
	Offsets for Life cycle Greenhouse Gas Emissions of Onshore Gas in the NT - seek feasible options to offset life cycle greenhouse gas (GHG) 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.	Near completion
	Methane emissions quantification of well drilling to completion processes in Beetaloo sub-basin - use autonomous emissions monitoring stations to quantify fugitive methane emissions from well construction and completion activities from unconventional shale petroleum exploration in the Beetaloo sub-basin. Results from this study will compare actual measured results with estimated results to verify the adequacy of existing calculated emission estimates.	Underway
Agricultural Land Management	Putting land management knowledge into practice - develop high-quality spatial data to help landholders, regulators, and the gas industry to evaluate design and placement of gas infrastructure, protect surface water and vegetation, and reduce erosion, soil damage and dust. Part of this work will include development of novel communication tools to improve exchange of data between groups.	Near completion
Terrestrial Biodiversity	Understanding and managing impacts to biodiversity from roads and pipelines in the Beetaloo - 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.	Underway
Land and Infrastructure	Background Seismicity of Beetaloo Sub-Basin and Seismic Hazard – this project will establish long-term background seismic data to characterise the current natural seismic activity in the Beetaloo Sub-basin in the Northern Territory. This baseline data can then be used to distinguish any possible increases in seismic activity resulting from future gas development and operations in the region.	Underway
	Beetaloo basin shale long-term competency after decommissioning – this project aims to quantify the self-sealing competency of shales in the Beetaloo basin that sit between the target natural gas seams and the shallow Cambrian Limestone Aquifer.	To commence in 2022/23

7.1.3 Northern Territory Research Progress and Expenditure

The committed Northern Territory research budget, expenditure and milestones completed for each project is provided in table 7.4 (* = completed projects).

Table 7.4 Committed research investment, expenditure and progress in Northern Territory, by project

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ²²	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
Surface and Groundwater	Baseline monitoring of groundwater properties in the Beetaloo Sub-basin, NT*	\$410,550	\$410,550	100%	100%
	Characterisation of the stygofauna and microbial assemblages of the Beetaloo Sub-basin*	\$346,890 ²³	\$346,909	100%	100%
	Improved approaches to long-term monitoring of decommissioned onshore gas wells*	\$352,436	\$356,346	101%	100%
	Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids*	\$291,964	\$297,923	102%	100%
	Onshore gas water lifecycle management options framework	\$409,833	\$259,135	63%	71%
	Fate of hydraulic fluids/chemicals and geogenic hydrocarbons in surface facilities and in the subsurface	\$854,255	\$478,502	56%	33%
	Examination of stygofauna ecosystems of the Beetaloo Sub-basin	\$1,763,967	\$0 ²⁴	0%	0%
Greenhouse Gas Footprint	Baseline measurement and monitoring of methane emissions in the Beetaloo Sub-basin*	\$305,297	\$311,931	102%	100%
	Mitigating fugitive gas emissions from well casings*	\$238,249	\$239,557	101%	100%
	Offsets for Life cycle Greenhouse Gas Emissions of Onshore Gas in the NT	\$417,884	\$417,923	100%	86%
	Methane emissions quantification of well drilling to completion processes in Beetaloo Sub-basin	\$655,846	\$297,773	45%	0%

²² Any expenditure exceeding 100% represents an additional CSIRO contribution.

²³ This includes \$53,858 in-kind contribution from CDU.

²⁴ This is a newly approved project. Expenditure will be incurred in 2022/23.

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ²²	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
Agricultural land management	Putting land management knowledge into practice	\$249,829	\$194,741	78%	50%
Terrestrial biodiversity	Understanding and managing impacts to biodiversity from roads and pipelines in the Beetaloo	\$319,520	\$75,737	24%	29%
Social and Economic	Mapping future transport passages and volumes for improved planning and operation*	\$194,308	\$194,450	100%	100%
Land and Infrastructure	Background Seismicity of Beetaloo Sub-Basin and Seismic Hazard	\$474,752	\$0 ²⁵	0%	0%
	Beetaloo basin shale long-term competency after decommissioning	\$470,306	\$0 ²⁶	0%	0%
TOTAL ALLOCATED BUDGET		\$7,755,887			

²⁵ This is a newly approved project. Expenditure will be incurred in 2022/23.

²⁶ This is a newly approved project. Expenditure will be incurred in 2022/23.

7.2 Northern Territory research ideas being discussed for 2022/23

The following project ideas are being discussed but are yet to be ratified and are subject to review by the relevant Research Advisory Committee. Over coming months further stakeholder consultation will occur aiming to prioritise these research ideas in relation to other community issues.

Table 7.5 Future research ideas in Northern Territory for 2022/23

SUBJECT AREA	IDEA	BASIN	ESTIMATED COST
Surface and Groundwater	An integrated project to understand surface water features of the Beetaloo region and potential connections with shallow groundwater systems that support them. The project would consider environmental and cultural significance of these water features, and the potential for interaction with unconventional gas activities.	Beetaloo	\$1.2M
Biodiversity	Surface habitat condition monitoring using remote sensing. This research would extend a feasibility study conducted as part of the Commonwealth Government's Geobioregional Assessment program to use remote sensing technology to monitor the condition of habitat in the Beetaloo SREBA region. It would also leverage the extensive data collection being undertaken through SREBA. The objective would be to develop an approach for routine assessment of habitat condition through time.	Beetaloo	\$600K

8 Western Australia R&D Plan & Budget

8.1 Western Australia Investment profile

8.1.1 Committed research investment for 2020/21-2024/25

The committed budget for projects in Western Australia for 2020/21-2024/25 now stands at \$2,300,877. A breakdown of the committed research budget across the various research subject areas is provided in Table 8.1 and Table 8.2 shows the investment committed by contributor.

Table 8.1 Committed research investment in Western Australia by research subject area, 2024/25

RESEARCH AREA	TOTAL RESEARCH INVESTMENT
Land and Infrastructure (94%)	\$2,150,378
Water (4%)	\$99,275
Biodiversity (2%)	\$51,224
Total	\$2,300,877

Table 8.2 Committed research investment in Western Australia by contributor, 2024/25

CONTRIBUTOR	CONTRIBUTION TYPE	TOTAL RESEARCH CONTRIBUTION
CSIRO (16%)	In-kind	\$364,547
Federal Government (21%)	Grant	\$481,530
Geological Survey of Western Australia (50%)	In-kind contribution to project W25 (Baseline seismic monitoring of the Canning Basin)	\$1,154,800
Geoscience Australia (13%)	In-kind contribution to project W25 (Baseline seismic monitoring of the Canning Basin)	\$300,000
Total		\$2,300,877

8.1.2 Western Australia Current Research Portfolio

A summary of all approved research projects in Western Australia is provided in table 8.3.

Table 8.3 Approved Western Australia Research Projects

RESEACH AREA	PROJECT	STATUS
Surface and Groundwater	Groundwater baseline study of the Canning Basin, Western Australia – explores and summarises the current state of knowledge of groundwater systems in the Canning Basin, Western Australia.	Completed
Terrestrial Biodiversity	Baseline assessment of the biodiversity of the Canning Basin, Western Australia - assess the current state of knowledge about the biodiversity of the Canning Basin in Western Australia.	Completed
Land and Infrastructure	Baseline seismic monitoring of the Canning Basin, WA - 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.	Underway

8.1.3 Western Australia Research Progress and Expenditure

The committed Western Australia research budget, expenditure and milestones completed for each project is provided in table 8.4. (* = completed projects).

Table 8.4 Committed research investment, expenditure and progress in Western Australia, by project

RESEARCH SUBJECT AREA	PROJECT	ALLOCATED BUDGET	EXPENDITURE	PERCENTAGE OF BUDGET SPENT ²⁷	PERCENTAGE OF MILESTONES COMPLETED
			UP TO 30 JUNE 2022		
Land and Infrastructure	Baseline seismic monitoring of the Canning Basin	\$2,150,378 ²⁸	\$98,183	5%	22%
Surface and Groundwater	Groundwater baseline study of the Canning Basin, Western Australia*	\$99,275	\$104,338	105%	100%
Terrestrial Biodiversity	Baseline assessment of the biodiversity of the Canning Basin, Western Australia*	\$51,224	\$51,221	100%	100%
TOTAL ALLOCATED BUDGET		\$2,300,877			

²⁷ Any expenditure exceeding 100% represents an additional CSIRO contribution.

²⁸ This includes \$1,154,800 in-kind contribution from GSWA and \$300,000 in-kind contribution from GA.

8.2 Western Australia research ideas being discussed for 2022/23

The following project ideas are being discussed but are yet to be ratified and are subject to review by the relevant Research Advisory Committee. Over coming months further stakeholder consultation will occur aiming to prioritise these research ideas in relation to other community issues.

Table 8.5 Future research ideas in Western Australia for 2022/23

SUBJECT AREA	IDEA	BASIN	ESTIMATED COST
Biodiversity	Following on from a desktop study identifying gaps in knowledge of the biodiversity of the large expanse of the basin, a follow up project would be designed to improve characterisation in areas identified as “High prospectivity for future exploration/operation”. The project will seek to identify key locations in collaboration with GSWA and PEL holders for timelines and activities. Areas would be prioritised based on a number of factors (risk, sensitivity, habitat change, climate factors, accessibility). Some of these areas are likely to experience competing use (e.g., UHS, CCS, CAES, Solar farms, natural hydrogen and gas exploration).	Canning	\$200-300k
Biodiversity	Biocultural knowledge in the Canning Basin is not well documented. This project would determine culturally significant species and ecological communities/locations (not all identified yet). Use of senior elders and linguists together with biologists to identify these culturally significant species/ communities/locations which have little or no data currently. Take this and results from first idea above and integrate understanding and provide knowledge exchange between local and western cultural information.	Canning	\$150-250k
Surface and Groundwater	The North Perth Basin has a history of oil and gas exploration. Its proximity to Perth makes it an economic location to provide locally sourced energy. It also has potential to be used for geological activities other than onshore natural gas exploration and production. This might include CCS, UHS, CAES and natural hydrogen exploration – and be impacted by overlying land use (i.e., farming and mining). This project would seek to evaluate the potential impacts on groundwater of these resource conflicts to provide data on the utilisation of water in the basin and how it might be monitored and managed in the longer term. The project may include increased sampling of bores, water head, and best monitoring tools, and testing of monitoring by passive seismic approaches. By testing these different approaches locally, abundant data can be used to improve models and attribute use and quality impacts for different industries in the region. This would be a multi-year long term study from which optimized approaches could be transferred to other basins across Australia.	North Perth	\$350-550k
Social and Economic Impacts	Based on previous community wellbeing studies in other states, it would be timely to commence a study in WA in the North Perth Basin region. This region hosts a variety of extractive industries and sits in the WA Wheat Belt. There is significant tourism and farming activities in the region. Mining operations, conventional gas and emerging geoscience solutions to energy are under consideration. This study would measure the current attitudes towards onshore gas in the context of the potentially varied land use and with reference	North Perth	\$250-350k

SUBJECT AREA	IDEA	BASIN	ESTIMATED COST
	to the outcomes of the WA EPA Scientific Inquiry into Hydraulic Fracturing.		
Land and Infrastructure	Seismic data acquisition is a core source of data and information for the onshore gas sector. As new acreage is released, companies plan to acquire new or additional data to make decisions on drilling. Acquiring these data can have surface environmental impacts as a result of land clearing, or where access is restricted due to location of other features (wetlands, mines etc.,) which may restrict the survey location and areal extent. This desktop study would identify better solutions for acquiring seismic data with negligible environmental impacts and testing different tools and configurations for acquiring seismic data that can be used to explore more accurately.	North Perth, Canning, Carnarvon Basins	\$150k

9 Proposed management and communication budget for 2022/23

Table 9.1 shows GISERA's actual management and communications expenditure during 2011-12 to 2021-22 financial years and the proposed management and communications budget for 2022-23.

Table 9.1 Proposed management and communications budget, 2022/23 with actual expenditure for 2011/12-2021/22

ITEM	ACTUAL EXPENDITURE	PLANNED EXPENDITURE	TOTAL
	2011/12 - 2021/22	2022/23	
Director, Deputy Director and State Leaders (salary & overheads)	\$2,847,570	\$287,757	\$3,135,327
Communication & Engagement team (salary & overheads)	\$2,650,672	\$691,634	\$3,342,306
Admin & Executive Officer support (salary & overheads)	\$2,194,948	\$277,758	\$2,472,706
Contractors	\$352,185	\$17,199	\$369,384
Travel & accommodation	\$416,443	\$66,000	\$482,443
Communication collateral (e.g., factsheets, brochures, infographics, videos & animations)	\$139,167	\$113,000	\$252,167
Website update (redesign and rebrand)	\$22,810	\$0	\$22,810
Conferences	\$69,330	\$35,000	\$104,330
Annual Symposium/Stakeholder & RAC meetings	\$78,417	\$20,000	\$98,417
General Expenses & Annual report	\$74,467	\$9,400	\$83,867
Public information sessions	\$47,573	\$35,000	\$82,573
Media training	\$26,287	\$2,000	\$28,287
Printing	\$18,230	\$1,400	\$19,630
Office supplies	\$12,745	\$1,300	\$14,045
Vodcasts	\$3,000	\$0	\$3,000
Auditor	\$0	\$0	\$0
TOTAL	\$8,953,844	\$1,557,448	\$10,511,292

Table 9.2 Partner contributions to management and communications, with actual expenditure for 2011/12-2021/22 and proposed for 2022/23

COMMS & MNGT COSTS CONTRIBUTIONS	ACTUAL CONTRIBUTION	PLANNED CONTRIBUTION	TOTAL
	2011/12 - 2021/22	2022/23	
CSIRO	\$3,735,457	\$339,524	\$4,074,981
Federal Govt	\$2,444,347	\$1,043,490	\$3,487,837
NSW Government	\$591,857	\$7,787	\$599,644
SA Government	\$217,392	\$0	\$217,392
APLNG	\$1,121,106	\$31,149	\$1,152,255
QGC	\$215,543	\$10,902	\$226,445
Origin	\$182,349	\$31,149	\$213,498
Santos	\$231,667 ²⁹	\$31,149	\$262,816
AGL	\$66,409	\$0	\$66,409
NT Government	\$121,110	\$62,298	\$183,408
Pangaea	\$26,607	\$0	\$26,607
TOTAL	\$8,953,844	\$1,557,448	\$10,511,292

²⁹ Santos contributing to two regions in previous Alliance Agreement

10 Communication

10.1 Overview

As gas exploration and development increases in regions around Australia, information about the impacts of the onshore gas industry is being sought by local communities, governments, land-use industries, environmentalists and the wider public. GISERA's accessible and transparent research outcomes are well placed to contribute constructively and objectively to this need.

CSIRO GISERA plays an important role in providing trusted information about the challenges and opportunities associated with the onshore gas industry.

Communication of CSIRO GISERA research has occurred using traditional and online media channels to reach wider community audiences. A key communication focus was development of innovative online communication products accessible directly by public audiences.

Summary of achievements over the life of GISERA



Figure 7 Summary of achievements over life of GISERA

10.2 Communication outputs

A suite of communication channels have been used to ensure effective and meaningful communication of research outcomes. Table 10.1 shows a range of communication outputs GISERA has achieved in 2021-22.

Table 10.1 Summary of technical and general communication outputs in 2021-22

COMMUNICATION PRODUCT	NAME OF COMMUNICATION PRODUCT	STATE / TERRITORY	RELEASE DATE
News Release	New Alliance Agreement for ongoing research on impacts of gas	National	July 2021
Journal Paper	Connectivity, not short-range endemism, characterises the groundwater biota of a northern Australian karst system	National	July 2021
Journal Paper	Beetaloo Sub-basin's digital twin and stygofauna	National	August 2021
Factsheet	Mitigating fugitive gas emissions from well casings	NT	August 2021
Factsheet	Baseline assessment of biodiversity of the Canning Basin	WA	September 2021
Factsheet	Monitoring community wellbeing and attitudes to CSG in Narrabri, NSW – 2022	NSW	September 2021
Factsheet	Baseline seismic monitoring in the Canning Basin, WA	WA	September 2021
Poster presentation	GISERA - 10 years on	National	September 2021
Final Report	Mapping future transport passages and volumes for improved planning and operation	NT	November 2021
Factsheet	Mapping future transport for improved planning and operation in the Beetaloo	NT	November 2021
Final Report	Groundwater baseline review of the Canning Basin, Western Australia	WA	November 2021
Factsheet	Groundwater baseline study of the Canning Basin	WA	November 2021
Knowledge transfer presentation	Assessment of faults as potential connectivity pathways	NSW	December 2021
Knowledge transfer presentation	Potential health impacts from CSG	QLD	December 2021
Newsletter	GISERA Newsletter - Issue 15	National	December 2021
Journal Paper	Stochastic Assessment of Groundwater Contamination Risks from Onshore Gas Development Using Computationally Efficient Analytical and Numerical Transport Models	SA	January 2022
Website launch	CSIRO's GISERA launches new website	National	February 2022

COMMUNICATION PRODUCT	NAME OF COMMUNICATION PRODUCT	STATE / TERRITORY	RELEASE DATE
Article	Award for CSIRO's stygofauna research	NT	March 2022
Article	Canning Basin seismic array to deliver wealth of real time data	WA	March 2022
Final Report	Assessment of the influence of geological structures on aquifer connectivity in the Pilliga Forest area, NSW – an integrated hydrogeological, geophysical, hydrochemical and environmental tracer approach	NSW	April 2022
Factsheet	Assessment of sub-surface faults as potential connectivity pathways in Narrabri, NSW	NSW	April 2022
Final Report	Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids	NT	May 2022
Factsheet	Improved approaches to long-term monitoring of decommissioned onshore gas wells	NT	May 2022
Final Report	Long-term monitoring of decommissioned onshore gas wells	NT	May 2022
Factsheet	Monitoring microbial communities in aquifers and soils of the Beetaloo Sub-basin	NT	May 2022
Factsheet	About Us	National	May 2022
Brochure	Summary of research projects	National	May 2022
Newsletter	GISERA Newsletter - Issue 16	National	June 2022
Article	CSIRO flies high to delve deeper into Narrabri faults	NSW	June 2022

10.3 Stakeholder Engagement

GISERA aims to achieve credibility, trust and respect from all stakeholders through the open and transparent conduct and communication of its research and synthesis activities.

Since launching CSIRO's GISERA in July 2011, the GISERA Director and CSIRO research staff have participated in 1,750 engagements with a range of stakeholders, such as federal and state Members of Parliament, industry associations, community groups, research organisations, gas developers, journalists and consultants.

Table 10.2 outlines the engagements for 2021-22 and Figure 8 shows stakeholder interactions over the last 11 years.

Table 10.2 Summary of GISERA engagements for 2021-22

STAKEHOLDER	NUMBER OF ENGAGEMENTS FOR 2021-22	NUMBER OF ENGAGEMENTS OVER LIFE OF GISERA
Regional community	57	193
Gas Industry	56	351
Federal, State and Local Departments and Agencies	96	532
Media (includes print, TV and radio)	16	229
School/Educational institutions/Students	2	19
Research organisations	22	206
Industry associations	3	130
Business groups	23	90
Total	275³⁰	1,750³¹

³⁰ It is important to note here that these numbers of interactions do not take into account the number of individuals engaged in that interaction. For example, regional community group interactions can range from 20-360 participants and a gas industry interaction can be a technical meeting with only 1-10 participants

³¹ It is important to note here that these numbers of interactions do not take into account the number of individuals engaged in that interaction. For example, regional community group interactions can range from 20-360 participants and a gas industry interaction can be a technical meeting with only 1-10 participants

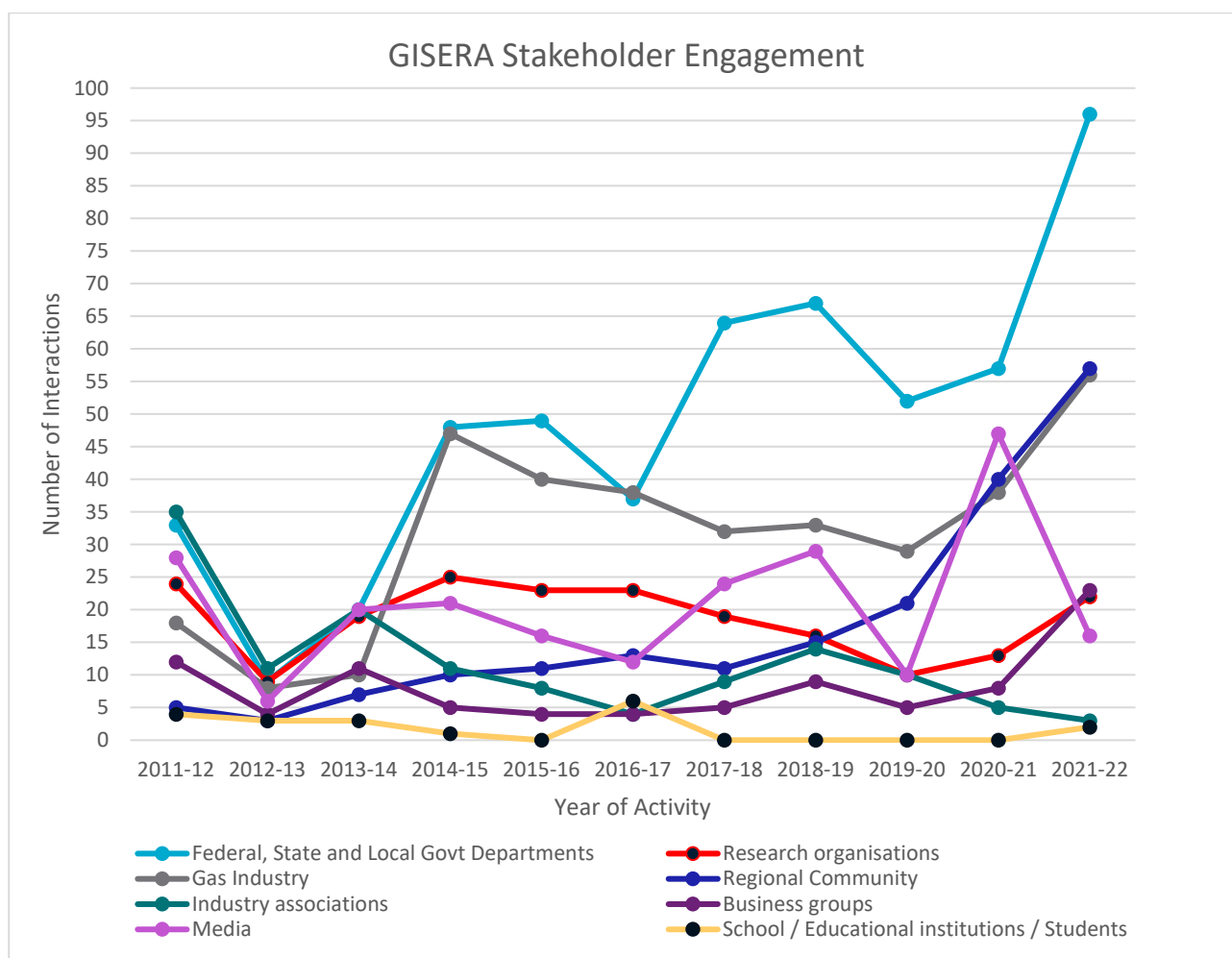


Figure 8 Stakeholder interactions from 2011/12 to 2021/22 - these numbers do not take into account the number of individuals engaged in that interaction. Regional community group interactions can range from 20-360 participants and a gas industry interaction from 1-10 participants.

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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.