



SOCIAL AND ECONOMIC IMPACTS

GISERA | Gas Industry Social and Environmental Research Alliance

Developing a wastewater lifecycle management framework for onshore gas development in the Northern Territory

This research project developed a framework - a decision-support tool - for the future management of water and wastewater from onshore shale gas development in the Northern Territory's Beetaloo Sub-basin.

The production of onshore shale gas in the Beetaloo Sub-basin will produce large volumes of water and wastewater; this is a key concern for the community.

CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA) has developed an options framework for how to best manage future water and wastewater.

Key points

- The community has concerns about water and shale gas development. There is a need for an economical, socially and environmentally sustainable approach to managing wastewater from gas production.
- CSIRO researchers reviewed the water qualities of NT shales, and the proximity of production to the industries that could use wastewater for beneficial reuse. They then identified water management approaches that could be used by shale gas operations in the NT.
- Researchers developed an NT-specific framework for decision-makers to choose future wastewater treatment and beneficial reuse options. The framework allows for the optimisation of environmental, social and economic objectives.
- These results help to increase understanding of water management options for shale gas production in the NT.

Research objectives

In this study, CSIRO scientists developed an options framework - based on sustainable water management principles - to manage water and wastewater for NT onshore shale gas development.

Scientists engaged with industry, government and community to develop a wastewater management approach that delivers broader benefits for society and community.

This included the creation of indicators to help gas operations measure the success of waste management practices.

Scientists explored the current and potential future options for the safe disposal of wastewater, reviewed treatment technologies, and determined (in consultation with industry) how feasible they would be to implement.

Two Beetaloo case studies were developed to test the framework's capability to deliver effective wastewater management solutions.

The Northern Territory

The Beetaloo Sub-basin is southeast of Katherine in the NT. The area has been identified as a potential area for onshore gas production. In 2018, CSIRO's GISERA partnered with the NT Government to deliver independent and transparent advice on gas development. This includes management of wastewater from shale gas production.



Shale gas development and wastewater

Shale gas is mainly methane trapped within shale rock layers, at depths greater than 1,500 metres. (It is different to the extraction of coal seam gas in several ways). Each well will likely produce 5 to 20 megalitres of water. There are three main sources of shale gas wastewater:

- **Well-drilling** muds to lubricate and cool the drill bit.
- **Flowback water**, which is the return of the hydraulic fracturing fluid injected into the well back to the surface. It can be saline, and contain chemical additives from the hydraulic fracturing fluid plus the native chemistries from deep in the shale formations.
- **Produced water**, which is formation water released during the fracture stimulation at depth and returns to the surface through the gas extraction process.

The quantity and quality of wastewater to be generated by shale gas in the NT are unique to the Beetaloo Basin and dependent on local geologies and extraction methods.

Dealing with wastewater

The Scientific Inquiry into Hydraulic Fracturing in the NT identified water as a high priority concern for the community. It recommended the development of a wastewater management framework, and that re-injection of wastewater (treated or untreated) into shale formations and discharge into drainage lines, waterways, temporary stream systems and waterholes be prohibited.

Australia is a dry continent, and there is often competition for water. There is a need to manage or reuse wastewater at gas production sites. In the NT, where possible, water must be treated or reused, and must be stored in closed tanks until treatment or disposal.

Managing wastewater within these constraints provides an opportunity for novel solutions.

There are six types of water treatment technologies: physical (e.g., filtration), thermal (adding heat to separate contaminants), proprietary, chemical, biological and membrane-based. This treated water could then be reused in mining, construction, and agriculture.

The research took a technologically agnostic approach; it does not prescribe particular technology choices for water reuse or treatment for the NT.

More information

Read the [final report](#)

Learn about other [GISERA projects in the NT](#)



Water is a precious resource in the Northern Territory.

Project outcomes

CSIRO researchers identified the quantity and quality of water likely at each stage of shale gas production. They then identified process, treatment or offtake opportunities. They found many available water management options (e.g., evaporation ponds, membranes, etc), but no single best solution. The best process will depend on the uses of water, contaminants to be removed, energy needs, wastewater treatment, and on-site treatment options.

Researchers then created a framework to identify and maximise opportunities for wastewater use and reuse that reduces costs and potential risks of environmental harm. Their findings included the following:

- While the industry is still in exploration phase, evaporation ponds are the most practical, efficient option for wastewater disposal in the Beetaloo.
- However, to minimise the environmental impact of wastewaters from hydraulic fracturing in shale gas production (beyond exploration), a combination of pre-treatment techniques, evaporation ponds for disposal of highly saline wastewaters, and new desalination technologies may be necessary.
- Centralised wastewater treatment facilities may help with economies of scale, and provide regional employment and economic activity.
- In the Katherine and wider Beetaloo region, there are potential mining, construction, and agricultural uses for treated reuse water.
- In Darwin, there may be further opportunities for industrial reuse, particularly in chemical industries.

There is currently limited data on shale gas extraction in the NT. A fuller assessment and use of this framework will be possible when there are a more wells, and when water qualities and volumes are better understood.

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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.