Australia's National Science Agency

GROUND AND SURFACE WATERS

GISERA | Gas Industry Social and Environmental Research Alliance

Baseline groundwater and seismicity of northern Perth Basin

CSIRO scientists will use non-invasive monitoring methods to establish baseline groundwater and natural seismicity levels across the northern Perth Basin.

Key points

- The northern Perth Basin is seeing a significant increase in energy-related industrial activities, including natural gas extraction.
- There is community concern about impacts on groundwater resources and potential seismic activity.
- This CSIRO project will use drill-free methods to gather baseline data about seismicity and groundwater depths.
- The study results will allow for monitoring and identification of any future impacts from gas developments.

Banner image: Northern Perth Basin landscape – courtesy Mid West Development Corporation.

The project addresses a recommendation from the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia (2018).

This project, conducted through CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA), will employ non-invasive methods to monitor seismicity (the occurrence and distribution of earthquakes) and groundwater depths across the northern Perth Basin in Western Australia.

Researchers will be able to detect and locate seismic activity and assess any annual variations in the data.

Their objective is to distinguish between variations in groundwater depths and seismic activity that occur naturally, and those that have anthropogenic (man-made) causes.

The results of this study will provide actionable insights to help communities, the resources sector and regulators improve water use management in the region.

The northern Perth Basin

The northern Perth Basin makes up the northern half of the Perth Basin in Western Australia.

The Perth Basin in its entirety is a north to north-northwest trending, onshore and offshore sedimentary basin that extends about 1,300 km along the southwestern margin of the Australian continent.

The northern section stretches for about 450 km from north to south, and up to 90km from west to east. It covers about 35,000 km^2, making up three-quarters of the onshore Perth Basin.

There is varied land use and industry in the region, including agriculture, renewable energy developments, and natural gas production sites.

The aquifers of the northern Perth Basin currently supply about 95 per cent of all water used for town water supplies, irrigated agricultural activities, mines and industries across the region.

CSIRO | Australian Government Department of Industry, Science and Resources | NSW Government | Supported by Government of South Australia | Queensland Government | Northern Territory Government
origin | Australia Pacific LNG | Shell | QGC | Santos | tamboran Resources | Empire Energy

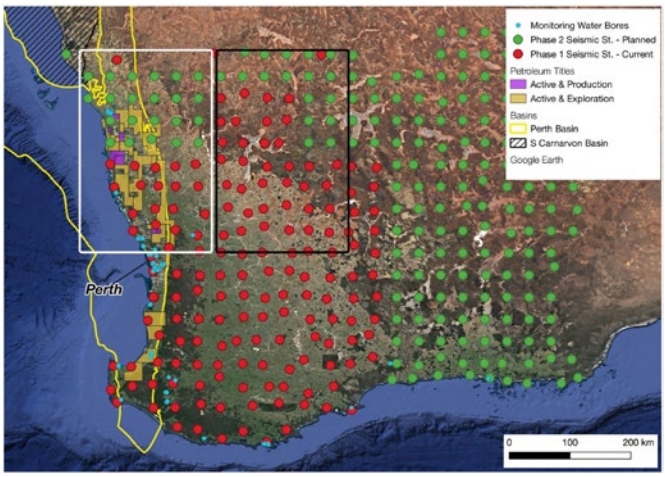
Addressing known knowledge gaps

Seismicity refers to the occurrence, distribution and behaviour of earthquakes within a particular region. It can be influenced by a range of factors, including tectonic plate boundaries, geological conditions and resource exploration activities. It is typically measured and analysed using seismic stations which record the ground motion.

The naturally occurring background seismicity of the northern Perth Basin remains poorly documented due to the limited historical coverage by seismic stations. Instrumental coverage is still relatively sparse in the region, but the Geological Survey of Western Australia (GSWA) has recently deployed seismic arrays that will help provide new information.

This CSIRO project will utilise seismic data from GWSA to build a baseline catalogue of natural seismic activity. This information can be used to compare future seismic events and determine whether they are consistent with the current background activity in the region, or whether they may have other causes.

The project will also use GWSA data to measure seasonal and spatial fluctuations of the hydraulic head of water in aquifers in the northern Perth Basin. A better understanding of variation in groundwater depth will provide the necessary context against which future variations – both natural and manmade – can be measured.



Current and planned passive seismic station distributions of the Geological Survey of Western Australia in Western Australia. Two rectangles show the regions of interests. White rectangle shows stations that are partially located in the northern Perth Basin and coinciding with petroleum titles. Black rectangle shows the location of seismic stations that is outside the petroleum titles and will be used as control group. Monitoring water bores are shown with blue circles (Source: Water Corporation).

Non-invasive monitoring methods

CSIRO scientists will use drill-free methods to monitor seismicity and groundwater depths across the northern Perth Basin.

These methods utilise seismic waves to detect subtle subsurface rock property changes, primarily driven by fluctuations in groundwater depths within alluvial and confined aquifers.

By integrating the datasets with CSIRO-developed subsurface monitoring techniques, the research team will be able to assess seasonal and annual variations in seismicity and groundwater depths.

This work builds on a previous GISERA project to characterise natural seismic activity and establish a more sensitive monitoring network in the Canning Basin, Western Australia.

It also addresses one of the recommendations from the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia (2018), which stated that "it is important to have a baseline of natural earthquake activity before unconventional gas extraction activities are started to ensure that any industrial activities are not seen to be producing excessive seismic activity."

Project outcomes

This project will provide important information to communities, industry stakeholders and regulators about the baseline seismic activity and fluctuations in groundwater depth in the northern Perth Basin. It will do so in a way that is transparent and accessible.

At a time when demand for groundwater resources is increasing, the results of the study provide an important evidence base for informed decision making and sustainable resource management.

More information

Find out more about this project.

Read about other GISERA studies in Western Australia.

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