GROUND AND SURFACE WATERS

GISERA | Gas Industry Social and Environmental Research Alliance

Developing flood model scenarios for Cooper Creek

CSIRO scientists have used modelling to improve our understanding of floods and droughts in the Cooper Creek catchment in Queensland, and have used story maps to make the results available in an accessible way.

This project, conducted through CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA), improves our understanding of floods and droughts in the Cooper Creek, Queensland.

Using computer modelling based on real-world data, researchers have explored how floods move through the Cooper Creek catchment. The data was then used to predict what impacts resource industry infrastructure and a range of different climate change scenarios might have on flooding.

Detailed flood modelling will help inform careful design of roads and other infrastructure on the floodplain and will also allow researchers to explore potential changes to water availability and persistence of critical waterholes.

A key output from this project is the development of Cooper Creek Flood Modelling story maps, which allow users to explore various flood modelling scenarios. The story maps improve understanding of floods in the Cooper Creek and the impacts of infrastructure under different climate scenarios.

The story maps show how floods move; down the Thomson and Barcoo Rivers, through their confluence to form the Cooper Creek – above Windorah and down to the Baryulah Floodplain, near the state border with South Australia.

Key points

- Researchers have developed detailed flood modelling to better understand how resource industry development and climate change might impact Cooper Creek.
- Flood modelling was identified as a high priority by the user panel for the Cooper region's Geological and Bioregional Assessment (GBA) Program.
- This project builds on models that were developed for the GBA Program in 2017–2021.
- Flood modelling scenarios were developed through a process of stakeholder engagement, including interviews and workshops.
- The resulting story maps show how floods move through the Cooper Creek catchment, and how they might be impacted by infrastructure and climate change.

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

Cooper Creek

Cooper Creek is part of one of the world's last major free-flowing desert river systems. It flows for 1,500 kilometres and has a vast, complex floodplain that spans a large area of south-west Queensland along with a smaller area of north-east South Australia.

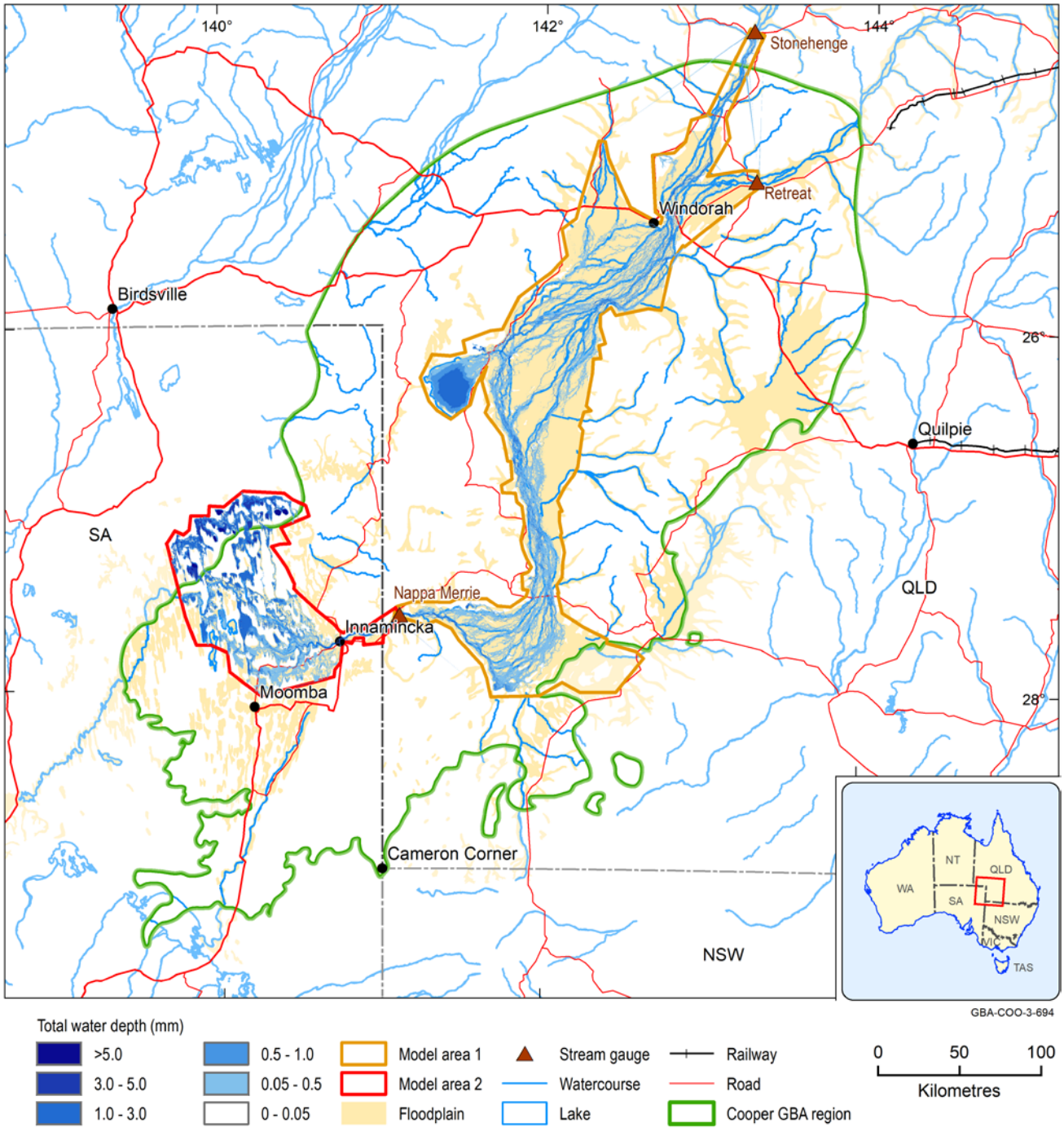
The Cooper Creek floodplain is about 32,000 square kilometres in size and floods frequently. It has highly variable terrain, very low gradients and very few data points. It is among one of the most complex floodplains in the world and is by far the most complex floodplain in Australia.

The region, particularly its rivers and floodplains, supports important environmental values including a rich biodiversity and populations of threatened species. From an environmental perspective, the Cooper Creek catchment is of national importance, and it is exceptional on a global scale.

The aquatic systems of the Cooper Basin are inhabited by a tremendous diversity of plants and animals, contain important cultural and spiritual values for Indigenous communities, and support a significant organic beef industry that depends on native pastures.

The environment features dramatic changes in condition, described as boom-bust, that is driven by pulses in water availability and thus primary productivity. Dramatic variation in rainfall and river flows in the region produce alternating phases of boom and bust that are not predictable over time. The region is currently experiencing significant flooding which will trigger a major "boom" phase as flood waters gradually recede.

Although some areas of the Cooper Basin are excluded from gas development, community concerns remain about the protection of the natural environment and the ongoing resilience of the Basin.



Map of the Cooper Creek floodplain

Making sense of GBA flood modelling

In 2017, the Cooper Basin was announced as the first region selected for assessment under the Federal Government's Geological and Bioregional Assessment (GBA) Program.

The user panel for this program noted the positive economic and social contributions the petroleum and gas industry had made in the region, but also agreed that careful management would be required to protect the unique environmental and cultural values of the Cooper Creek and its floodplain

This GISERA project builds on existing flood inundation models developed for the GBA Program.

There has been a high level of public interest in those models, but their size and complexity mean that stakeholders are unable to access the necessary computing resources to run their own scenarios.

The Cooper Creek flood modelling story maps developed as a key output for this project are designed to make the data easily accessible to a wide range of users.

Project methods and objectives

Many different groups are interested or concerned about flooding in the Cooper Creek and surrounding floodplain, including conservationists, local governments, Traditional Owners, agricultural producers, and petroleum and gas industry workers.

This GISERA project represented an important opportunity to strengthen and develop the positive stakeholder relationships that were built during the GBA Program. A key aim was to ensure that flood modelling scenarios developed through the project are relevant to the people who live and work in the region.

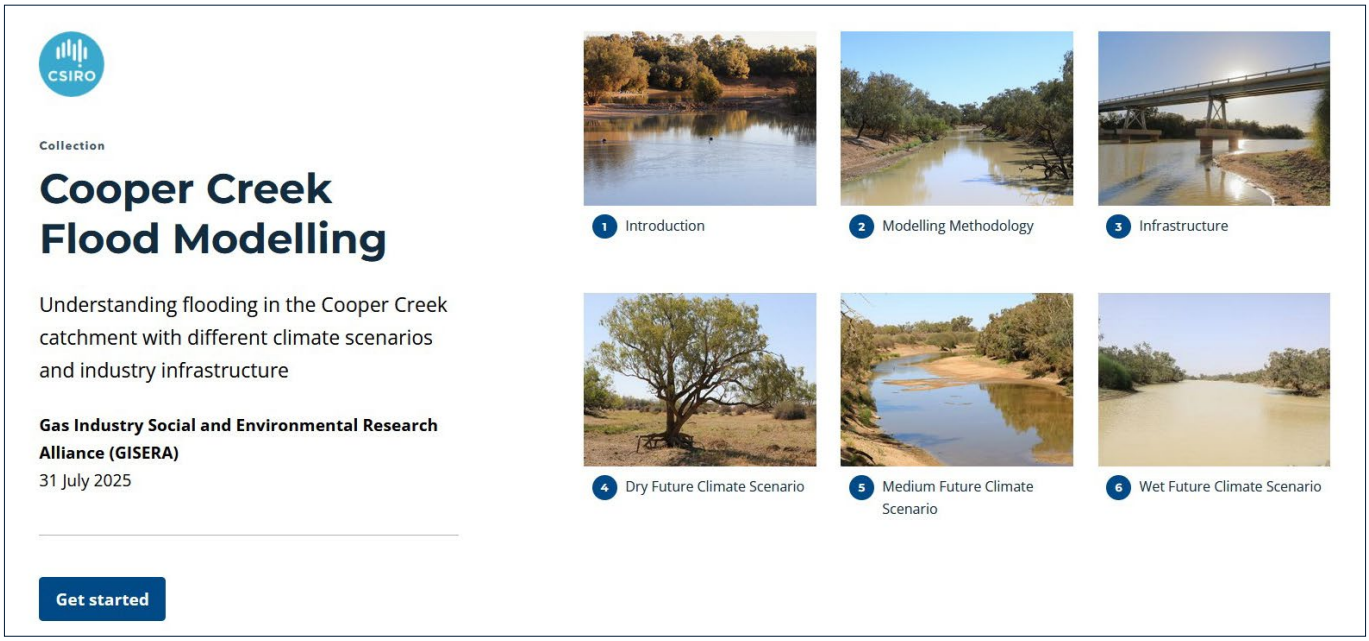
This was achieved through workshops and interviews. The stakeholder views gathered through the engagement process were used to define flood modelling scenarios that considered:

- Flood risk and flood characteristics under future climate scenarios, and
- Flood characteristics due to floodplain infrastructure, extraction, or diversions needed for future gas industry development.

Researchers used computer models with real data to generate a series of snapshots over time, showing where the floodwaters flow in the Cooper Creek catchment. When these snapshots are run together, they create a useful animation, showing the flood overtopping the main channel and spreading over the floodplain.

Once they had the initial flood model results, researchers were then able to develop a range of scenarios – guided by the needs of stakeholders – to show how flooding in Cooper Creek and the floodplain could be affected by infrastructure and climate change.

Cooper Creek floodplain



Cooper Creek flood modelling story maps website

Scenarios and case studios

Researchers simulated changes to floods with and without structures on the floodplain using historical climate data, and then simulated what may happen as the climate changes over the next 50 years.

Flood models were developed to show three possible future scenarios: whether it gets drier (Dry climate), neither drier nor wetter (Medium climate), or whether it gets wetter (Wet climate).

This approach allowed researchers to develop 12 different case studies, which were:

Effects of floodplain structures on flooding

- Well pads
- Borrow pits
- Roads and tracks

Impacts of a dry future climate on flooding

- Grazing
- Fish connectivity
- Lignum habitat

Impacts of a medium future climate on flooding

- Floodplain fringe
- Bird life
- Town water supply

Impacts of a wet future climate on flooding

- Vehicle access
- Fish passage
- Weeds and pests

For each of these, there is interactive data and accessible information available on the dedicated Cooper Creek flood modelling story maps website.

Model outputs such as water velocities, depth, and duration of inundation are included, as these are useful to analyse the impacts of a flood on infrastructure or ecologically important features on the floodplain. Other variables such as soil saturation and infiltrated water volume may also be useful.

Each case study introduces and explains the relevance of the selected threshold for the case study. Modelling results for each case study are presented using maps of the difference between scenarios for a threshold.

Thresholds were chosen in consultation with the people who live and work in Cooper Creek, to ensure this information is useful and relevant for their needs.

Taken as a complete body of work, this project and its outputs meet a clear community need for concise and accessible information about the hydrology of Cooper Creek floodplain.

More information

Read more about this project

Explore the Cooper Creek flood modelling story maps

Learn about other GISERA research in Queensland

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

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