GISERA | Gas Industry Social and Environmental Research Alliance

Progress report

Cooper Creek flood modelling scenarios

Progress against project milestones

Progress against milestones/tasks are approved by the GISERA Director, acting with authority in accordance with the GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: <u>Traffic light reports</u> and descriptive <u>Project schedule reports</u>.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:

- **Green**:
    - Milestone fully met according to schedule.
    - Project is expected to continue to deliver according to plan.
    - Milestone payment is approved.

- **Amber**:
    - Milestone largely met according to schedule.
    - Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
    - Milestone payment is withheld.
    - Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.

- **Red**:
    - Milestone not met according to schedule.
    - Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
    - Milestone payment is withheld.
    - Project review initiated by GISERA Director.

2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

Project schedule table

TASK NUMBER	TASK DESCRIPTION	SCHEDULED START	SCHEDULED FINISH	COMMENT
1	Define scenarios	June 2022	Sept 2022	Completed
2	Flood modelling	July 2022	June 2023	Completed
3	Project reporting	April 2023	Sept 2024	Completed
4	Communicate findings	July 2022	Sept 2024	Completed

Project schedule report

TASK 1: Define scenarios

BACKGROUND

The project builds on existing flood inundation model developed for the Geological and Bioregional Assessment Program. The size and complexity of the flood inundation models mean that stakeholders are unable to access the necessary computing resources to run their own scenarios. Prior to any stakeholder workshops, an initial work plan, ethics approval and data management plan will be completed.

TASK OBJECTIVES

The objective of the initial stakeholder workshop is to engage with stakeholders to define 2-3 flood modelling scenarios and test visualisation options.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Work plan, ethics approval, stakeholder workshop, list of modelling scenarios, visualisation preferences and data management plan.

PROGRESS REPORT

This milestone is complete.

The project team obtained ethics approval (106/22) before speaking with stakeholders to prioritise flood modelling scenarios. Initial conversations with industry representatives from two industry stakeholders, focused on understanding how the flood modelling scenarios could best inform their day-to-day operations. Flood likelihood mapping under current and future climate inflow scenarios was a priority for industry.

A workshop with a broader range of stakeholders is planned in the future to explore how to best communicate and visualise the flood model outputs. Future engagements are planned with government regulators and science experts to further refine priority flood model outputs and visualization preferences from these 2 climate scenarios.

TASK 2: Flood modelling

BACKGROUND

In this task, the state-of-the-art hydrodynamic flood inundation model will be modified to represent the 2-3 flood modelling scenarios defined in Task 1. A stakeholder workshop in late 2023 will be used to finalise flood modelling scenarios. Outputs from the hydrodynamic modelling include estimates of spatial flood extents across the modelling domain, and water depth and velocities for each mesh element for each scenario.

TASK OBJECTIVES

The objective of this task is to develop, run, and assess flood models which represent the 2 to 3 modelling scenarios defined in Task 1.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Updated model setup used for 2-3 flood modelling scenarios, including model mesh and all related setup files (e.g., rainfall, potential evapotranspiration, LiDAR DEM, river and water holes bathymetry, classified Landsat images for the selected floods, soil characteristics, vegetation characteristics, observed streamflow at the upstream gauges and ungauged inflows along the model domain boundaries estimated using a regionally calibrated rainfall-runoff model), and validation statistics for each scenario.

PROGRESS REPORT

This milestone is complete.

The MIKE21 flood model was calibrated for the GBA Program for historical floods in the Queensland model area with a 1 in 2-year return period using 2018 data, a 1 in 5-year return period using 2006 data, and a 1 in 10-year flood using 2004 data. The team have completed their final checks of model outputs for an additional 12 flood model runs:

1. Historical climate calibration x 3 flood sizes (3 existing model runs), flood model runs were previously calibrated based on availability of continuous daily streamflow data and Landsat satellite images.
2. Historical climate with infrastructure x 3 flood sizes (3 new model runs), flood model runs include an explicit representation of existing roads and well pads
3. Future climates (dry, mid, wet) with road and well pad infrastructure x 3 flood sizes (9 new model runs), flood model runs include existing infrastructure for 3 climate projections, including changes to rainfall, evapotranspiration, and surface water inflows in the model.

The existing flood model was augmented with explicit representation of existing road and well pad infrastructure, focusing on the major roads traversing the floodplain near Windorah and Devon Downs, as well as existing well pads and access roads on the Baryulah floodplain.

Outputs from the hydrodynamic flood inundation modelling include estimates of spatial flood extents across the modelling domain, and water depth and velocities for each mesh element for each scenario. Stakeholder interviews identified 3 critical thresholds needed to interpret changes to flooding between scenarios:

1. Number of days inundated (includes vehicle access and pasture growth)
2. Number of days deeper than 0.3 m (includes access wheel height and waterbird fledging)
3. Number of days flows greater than 0.3 m/s (includes vehicle access and fish flows).

Next, the project team finalised the spatial analysis of the 12-flood model runs to evaluate how flood characteristics in the complex Cooper Creek floodplain may change under future development and climate change scenarios. These spatial outputs were tested at stakeholder workshops held in late 2023 to finalise flood modelling outputs and test the communication of findings with users. The workshop provided stakeholders with an opportunity to discuss and give feedback on what matters to them and for the team to finesse reporting of the model outputs and key messages. The stakeholder workshops identified a new flood threshold (infiltration depth, mm) related to plant growth and floodplain productivity for the 'Grazing' case study.

TASK 3: Project reporting

BACKGROUND

Information from this project is to be made publicly available after completion of standard CSIRO publication and review processes.

TASK OBJECTIVES

To ensure that the information generated by this project is documented and published after thorough CSIRO Internal review.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

1) Preparation of flood model scenario dataset with supporting methods report to document model set up and validation results of a 2D hydrodynamic model (MIKE21FM);

2) Following CSIRO ePublish review, the report will be submitted to the GISERA Director for final approval; and

3) Provide 6 monthly progress updates to GISERA office.

PROGRESS REPORT

This milestone is complete.

The project team have finalised the content of the 6 story maps:
- [Story map 1](#) shows why the flood model was built and how we developed the infrastructure and future climate scenarios that are relevant to the people who live and work in the region.
- [Story map 2](#) shows how we built the models, from collecting the data, to calibrating the model and creating the different scenarios. It then shows how to interpret the flood model results for the different scenarios.
- [Story map 3](#) shows how infrastructure could change flow patterns for 3 types of infrastructure – well pads, borrow pits, roads and tracks. The case studies use maps of the difference between the Infrastructure and Baseline scenarios.
- [Story map 4](#) shows how a dry future climate could change flow patterns for grazing, fish connectivity and lignum habitat. The case studies use maps of the difference between the Dry future climate (with structures) and Infrastructure (with structures and historical climate) scenarios.

- [Story map 5](#) shows how a medium future climate could change flow patterns for the floodplain fringe, bird life and town water supply. The case studies use maps of the difference between the Mid future climate (with structures) and Infrastructure (with structures and historical climate) scenarios.
- [Story map 6](#) shows how a wet future climate could change flow patterns for vehicle access, fish passage and weeds and pests. The case studies use maps of the difference between the Wet future climate (with structures) and Infrastructure (with structures and historical climate) scenarios.

TASK 4: Communicate project objectives, progress, and findings to stakeholders

BACKGROUND

Communications of GISERA research are an important component of outreach and dissemination of findings to diverse audiences. This project will leverage existing relationships developed with user panel members in the Cooper Basin to ensure broad stakeholder engagement.

TASK OBJECTIVES

Communicate project objectives, progress, and findings to stakeholders through meetings, knowledge transfer session, factsheet, and journal article, in collaboration with GISERA Communications officers. It is anticipated that flood modelling scenarios will be shared with a general audience through a 2-page fact sheet summary in plain English with links to visualisation and modelling dataset(s) and visualisations of modelling scenarios based on user needs. The final stakeholder workshops to communicate outcomes from modelling scenarios were held in Longreach and Brisbane in late 2023.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Communicate project objectives, progress, and results to GISERA stakeholders according to standard GISERA project procedures which may include, but not limited to:

1) Knowledge Transfer session with Government/Gas Industry

2) Presentation of findings to Community members/groups

3) Preparation of article for GISERA newsletter and other media outlets e.g. The Conversation

4) Revision of project factsheet to include results (a factsheet is developed at project commencement, and another will be done at completion)

5) Peer reviewed scientific manuscript ready for submission to relevant journal (if possible)

6) Digital innovative and interactive flood model visualisation platform

PROGRESS REPORT

This milestone is complete.

- The project team met with stakeholders in Longreach and Brisbane in late 2023.
- The knowledge transfer session with government and industry stakeholders was conducted in March 2024.
- Online story map content was internally peer reviewed.
- The project team have finalised the content in the online story maps.

- An end of project fact sheet is currently being developed.

VARIATIONS TO PROJECT ORDER

Changes to research Project Orders are approved by the GISERA Director, acting with authority, in accordance with the GISERA Alliance Agreement. Any variations above the GISERA Director's delegation require the approval of the relevant GISERA Research Advisory Committee.

The table below details variations to research Project Order.

Register of changes to Research Project Order

DATE	ISSUE	ACTION	AUTHORISATION
03/04/24	Delay due to a third-party provider now contracted to fulfill the delivery of the communications products	Milestones 3 and 4 extended from March 2024 to September 2024	

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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.