2024

Annual Report

GOYDER INSTITUTE FOR WATER RESEARCH

The **Goyder Institute for Water Research** is a collaborative partnership of the South Australian Government through the Department for Environment and Water, CSIRO, Flinders University, the University of Adelaide and the University of South Australia.

The Institute facilitates collaboration of governments, industries, research organisations, communities and First Nations to identify, develop and adopt sustainable, innovative and integrated solutions for complex water management challenges.

Government of South Australia
Department for Environment and Water

CSIRO

Flinders University

THE UNIVERSITY of ADELAIDE

University of South Australia

A message from our Chair

As the new Independent Chair of the Goyder Water Research Institute in 2024 it has really struck me that research to inform management of our water resources is needed more than ever.

With climatic extremes increasing and the challenge of providing safe and reliable water to remote and regional communities becoming clearer each day it is vital that quality research informs our management decisions and sustains our people and landscapes.

The Goyder Water Research Institute continues to provide a powerful vehicle to meet these research needs bringing expertise from across each of our partner organisations. The model allows for the best researchers to work in multidisciplinary teams to solve the problems that face us in delivering sustainable water resource management. This in turn lends itself to holistic projects and solutions, working in partnership and not at odds or in competition.

Since 2020 the Institute has secured over $19.6 million in funding and delivered a portfolio of 23 projects, with over 266 researchers and numerous communities, First Nations and management agencies engaged.

This year saw the Institute open the Coorong, Lower Lakes and Murray Mouth Research Centre at Goolwa enabled by an $8 million investment from the Federal Government through the Department of Climate Change, Energy, the Environment and Water. This builds on a portfolio of previous research delivered by the Goyder Institute in the CLLMM region, including the $7.7 million Healthy Basin, Healthy Coorong Trials and Investigation Program jointly funded by the Australian and South Australian governments.

The Institute has a track record of designing, implementing and delivering major research projects but the CLLMM Research Centre has taken on new heights of innovation with an inclusive model placing First Nations and community, along with regional organisations, at the forefront of science and knowledge generation and sharing. Find out more in this report and the message from the Director.

We were also very proud this year to work with Desert Knowledge Australia to focus on the challenges faced in proving drinking water to remote communities. A forum in Alice Springs with a strong contingent of Aboriginal and Torres Straight Islanders identified the action required to improve drinking water in outback and bush communities. Look at our website and read on in this report to look at this and other key projects delivered in 2024.

The Institute continues to create value and impact by delivering research and solutions that enable decision-making, showcasing South Australian research institutions, promoting and communicating science and research to a broader audience, and leveraging investment for both partners and funders.

The current funding term for the Institute began in July 2023 and expires in June 2026. Partners are working together to ensure a timely and smooth transition into a new term for the Institute.

We have a strong Board representing our partners and a diverse Research Advisory Committee ensuring our research is well considered and informed by our many stakeholders. Our staff are nothing short of incredible and we have a wealth of expertise across our partner institutions and collaborators.

I'm proud to work with our Director Alec Rolston to present this annual summary of activities and I look forward to a bright future for Goyder.

Jody Swirepik
Independent Chair
Goyder Institute for Water Research

A message from our Director

This has been an exceptionally busy year for the Goyder Institute for Water Research as we have continued to build the strength of the Institute, working with new collaborators to deliver a broad range of critical water research projects to inform decision making.

We started 2024 with a sense of renewal as we welcomed Jody Swirepik as our new Independent Chair. It's been wonderful to work with Jody over the past year, learning from her significant experience to work with our partners to build a positive future for the Institute.

In January, our Coorong, Lower Lakes and Murray Mouth (CLLMM) Research Centre moved into its new premises in Goolwa. We're very grateful to Alexandrina Council and the University of Adelaide for working with us to enable us to have such spectacular office and community space on the banks of the River Murray as the river flows through the Goolwa Channel on its way to the Southern Ocean.

As we began the new year, the CLLMM Research Centre entered its delivery stage, initiating a flurry of engagement activity as we worked with community, First Nations, management agencies and scientists to identify, prioritise, co-develop and co-deliver the Centre's Science Program.

The Centre's activities, led by our incredible team based in Goolwa, have engaged thousands of individuals and hundreds of organisations as it seeks to build the knowledge base to inform planning, adaptation and decision making relating to climate change impacts in the CLLMM region.

In February, we released our outputs from the *Working together for better drinking water in the bush* forum which was a transformational forum that led to the identification of 12 key items for action to assist in achieving better drinking water quality in the bush. This work was funded by the Australian Government through the National Water Grid Authority and delivered in partnership with Desert Knowledge Australia and Flinders University.

The forum outputs are informing progress and decision making to improve access to clean, safe and secure drinking water for remote communities. In November 2024, the significance of the work was recognised when it received a high commendation for the Australian Water Association SA Branch R&D Excellence Award.

We have also been closing out four other key projects and have strengthened our relationship with the One Basin Cooperative Research Centre by confirming our administrative hosting of the CRC's research hub located in Loxton, South Australia. This collaboration creates a knowledge partnership within the Lower River Murray in South Australia, increasing connectivity to address the challenges that lie ahead at the end of Australia's largest river system.

Across the year, we have had a number of changes within the Institute team. In July we bade farewell to Nathan Hartman as our First Nations Engagement Officer with the CLLMM Research Centre; and in August we welcomed Ramindjeri/Ngarrinjeri woman Kyla McHughes into the role.

That same month, we said goodbye to Bryony Cotterell as Research Program Manager, and also welcomed Sue Ellison to the CLLMM Research Centre. Sue has stepped into the role of Communications and Engagement Coordinator at the Research Centre. We have also recently extended the secondment of Fiona Adamson from Flinders University to the Institute.

Much of the strategic focus of the past year has been working with our Institute Partners to continue the Institute beyond the end of its current term of 30 June 2026. Discussions have been very positive, and we look forward to progressing further in 2025 and continuing the momentum of the Institute.

Investment in scientific research is an investment in robust decision making. The expertise within our Partner organisations is world-class and now more than ever, that expertise is needed to create the knowledge and develop the solutions to the complex challenges of water resources management. I'm very much looking forward to another exciting year ahead for the Goyder Institute.

Dr Alec Rolston
Director
Goyder Institute
for Water Research

2024 highlights

Our work has continued to deliver important and impactful research.

January marked the beginning of the **delivery phase of the CLLMM Research Centre** as we moved into the Centre's new home in Goolwa, South Australia.

In February, we released the outputs from the **Working together for better drinking water in the bush** forum.

Our **Adaptation of the South-East drainage system under a changing climate project**, working with the Limestone Coast Landscape Board, is continuing, with the project team delivering impactful research that is informing decision making in the south-east of South Australia.

We formally established the administrative delivery of the **One Basin Cooperative Research Centre's Loxton Research Hub**, creating connectivity for the Goyder Institute throughout the South Australia Lower River Murray region. We continue to be a Tier 1 Partner in the CRC, representing our Goyder Partner organisations on the CRC's Leadership Team and Partner Forum.

Four significant projects were completed in late 2024.

- **Potential impacts of reducing groundwater abstraction from the south west Great Artesian Basin: Modelled aquifer pressure and spring flow response.** This report was published in November 2024.
- **Assessing the environmental response of the 2022-2023 River Murray flood event.** Project outputs were published in December 2024.
- **Development of ecohydrological conceptual models and Impact Pathway Diagrams for the Braemar, Stuart Shelf and Northern Eyre regions.** Project outputs were published in December 2024.
- **Analysis of changes in high intensity rainfall events in South Australia.** Project completed in December 2024, with outputs anticipated to be published in early 2025.

Our goals and impact areas

Our work continues to focus on our four key impact areas:

Water for people

Progress integrated water management solutions to provide safe, reliable and affordable water for urban, regional and remote communities and deliver cultural and social benefits.

Water for the environment

Restore and protect water dependent ecosystems and ecological assets to maintain biodiversity and support health and wellbeing of communities.

Water for industry

Provide sustainable water solutions to industries such as agriculture, mining, energy and green hydrogen and support sustainable economic growth for communities.

Climate adaptation

Guide action on climate adaptation and resilience for water for people, environment and industry.

Our goals through to June 2026 are for the Institute to:

- Establish a large, diverse and impactful research portfolio
- Successfully deliver established research projects
- Continue to build capacity and capability in Institute partners and end-users
- Continue to build the collaborative model through the establishment of new project partners
- Seek to be recognised nationally as a trusted source for undertaking independent and impactful research
- Establish a viable long-term operating model that will lead to a fourth term of the Institute
- Focus on research projects that make an impact on the most challenging and pressing issues, including the UN Sustainable Development Goals, National Water Initiative, the Basin Plan, Closing the Gap, Climate Change Actions and Integrated Urban Water Management.

The impact and value of our work

Since 2020, we have delivered a portfolio of 23 projects through $19.6 million funding, involving 266 researchers.

We deliver value and impact across a range of areas, including:

- Delivering research and solutions that enable decision-making. All of the work of the Institute is applied and designed to inform decision-making, whether it be by government, industry, the community or First Nations
- Showcasing South Australian world-leading research Institutions and expertise at local, national and international scales
- Participating in cutting edge research and science, working on issues that directly impact decisions, and ensuring that outcomes are well communicated
- Promoting and communicating science and research to a broader audience to maximise the impact and dissemination of our work.

In 2024, we have established new relationships on the international stage, showcasing our work and the expertise of our partner organisations and researchers.

Through the CLLMM Research Centre in particular, we are delivering a different model of knowledge development and delivery at the end of the Murray Darling Basin, engaging thousands of people and hundreds of organisations in our work.

We have created connections and linkages within our partner organisations as well as between our researchers and government agencies, community and First Nations. We are working to make science and research accessible to communities, listening to their needs and providing information and knowledge in a timely and accessible manner.

Through the Institute's projects, we are growing a pool of future scientists and researchers, by involving early career researchers in our work, and engaging with schools and associated youth groups and events.

Over the past year, we have:

- Delivered research projects on behalf of four new funding partners
- Strengthened relationships with our established partners and ongoing funding bodies
- Continued to highlight the capabilities and capacity of South Australian researchers at the national and international scales
- Engaged communities, First Nations, government agencies and researchers in critical water-related issues
- Discussed our work with local, state and federal elected representatives to facilitate the pathway for our work to inform policy and decision making
- Published our work through technical reports and our researchers have published their work in international peer-reviewed journals
- Worked hard to make our research more accessible to broader audiences, including developing fact sheets, briefing notes, workshops, media releases, videos, print and radio media, and science forums, school engagements, and locally focussed events
- Embedded research end-users, including government agencies (state and federal), communities, First Nations and researchers in the design and delivery of our projects, ensuring that our work informs decision-making points throughout the term of our projects
- Communicated the collaborative partnership approach of the Institute and its project outputs to state, national and international audiences through online webinars, conferences and forums.

Research Showcase: Coorong, Lower Lakes and Murray Mouth (CLLMM) Research Centre

Following completion of its six-month establishment phase, our Coorong, Lower Lakes and Murray Mouth Research Centre began its delivery phase on 1 January 2024. This included moving into our new home on the banks of the Goolwa Channel, just a few kilometres upstream of where the River Murray enters the Southern Ocean.

The CLLMM Research Centre was established following $8 million funding from the Australian Government to work with communities and First Nations to address the impacts of climate change on the CLLMM region.

The region is the only location in the 1 million km^2 Murray Darling Basin where changes to river flow and water quality are being experienced in combination with sea level rise, creating a unique set of challenges that have profound and cascading impacts.

Over the course of 2024, the growth and development of the Research Centre has been incredible, built on the engagement and investment of the local community, First Nations, business and industry, management agencies and scientists.

The Research Centre is now an important regional independent scientific presence We have made significant progress in creating a trusted, culturally safe, collaborative place to develop and share knowledge, delivering social, cultural, economic and environmental benefits to the region. This is being achieved through an inclusive model which places First Nations and community, along with regional organisations, at the forefront of science and knowledge generation and sharing.

Thousands of people and hundreds of organisations are connecting with us – for example, over 1,000 people and 50 organisations contributed to the development of our Science Program. Our Year 1 Progress Report[1] highlights our achievements through to June 2024, and the investment by so many people and organisations in our activities.

Overseen by our governance structures and extensive engagement, the perspectives of community, First Nations, scientists and management agencies have shaped the direction of the Science Program that includes 25 co-developed research projects[2].

[1] CLLMM Research Centre Year 1 Progress Report 2023/2024

[2] Whiterod, N. (2024). The Coorong, Lower Lakes and Murray Mouth Research Centre Research Plan 2023-26

Through the CLLMM Research Centre, we are engaging 100 scientists and 10 regional organisations to deliver these projects, with extensive opportunities for First Nations and community involvement. We have established pathways for providing critical knowledge to understand and respond to climate change.

Significant in-kind investment across research teams along with that provided by volunteers, management agencies and collaborators. This includes $3.5 million in-kind investment from the Goyder Institute for Water Research partner organisations and regional organisations to deliver the Science Program.

Over the next year, our Science Program will be continuing and we will be sharing research outputs as they become available. Our pilot school education program will begin in 2025; and we will be hosting many engagement events, workshops, science forums and discussions. We will also be working hard to secure the sustainability of the CLLMM Research Centre beyond 2026.

Snapshot of engagement in the science program:

4

project types

1. Foundational
2. Flagship
3. Research
4. Knowledge sharing and capacity building

25 **projects**

Direction guided by input from

>50 organisations and >100 people

Delivered by

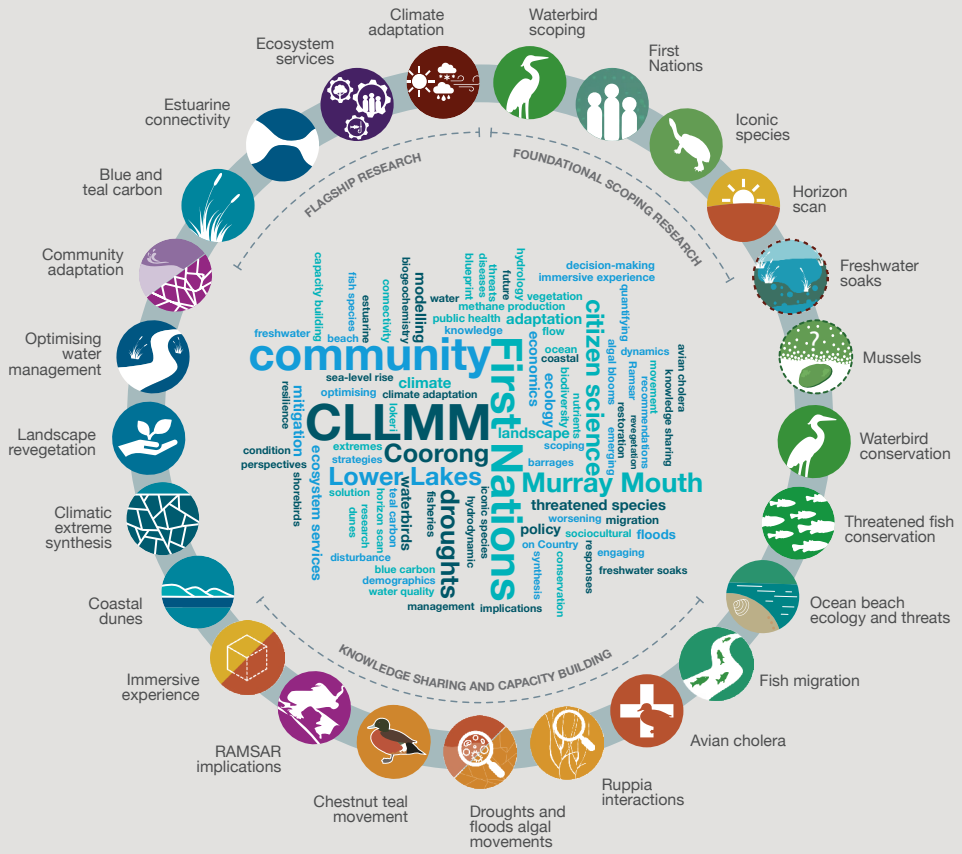
100

scientists and >10 regional organisation

$5 million

cash invested;
~$3.5m in-kind leveraged

The 25 projects of the CLLMM Research Centre Science Program:



Research Showcase: Ecohydrological Conceptual Models

Through joint funding from the South Australian Department for Environment and Water and the Department for Energy and Mining, research teams from Goyder Institute Partners CSIRO and Flinders University delivered a pilot project to develop Ecohydrological Conceptual Models (ECMs) and Impact Pathway Diagrams (IPDs) for the Braemar, Stuart Shelf and Northern Eyre regions in the north of South Australia.

The ECMs and IPDs were developed in the context of regional development of mineral resources and large infrastructure in these regions.

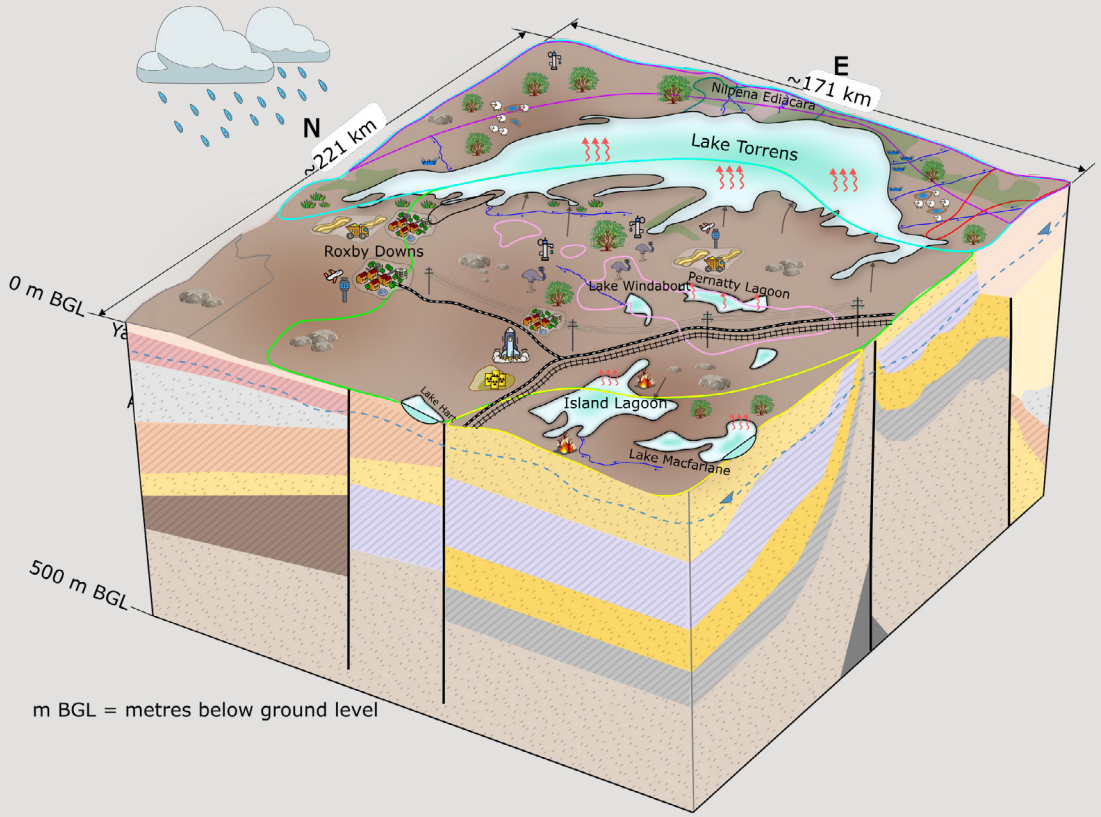
Ecohydrological Conceptual Models provide a visual understanding of the connections between water and the environment, combining information on hydrology (surface water and groundwater), geology, soils and ecology (species, communities and ecosystems). ECMs are often portrayed as a pictorial graphic with descriptive narrative or icons.

Impact Pathway Diagrams use the information from ECMs to understand and communicate how resource development such as mining or renewable energy generation can affect water resources and the surrounding environment. IPDs are often displayed as a web highlighting all the relationships between a specific activity, a process and an end point.

This was the first application in South Australia of new national guidelines for incorporating ecohydrological conceptualisation in environmental impact assessment. The project engaged a broad range of parties within the case study regions, incorporating a wealth of First Nations knowledge and management perspectives into the development of the ECMs and IPDs.

The result of the project is a comprehensive, regional-scale hazard identification that can form the basis of a spatial risk assessment for future developments in regional South Australia. Outputs include 24 fact sheets, and a detailed outline of the methodology used, all of which are available on the Goyder Institute for Water Research website.

Example of ECM for the Stuart Shelf region:



Land use
- Major mines
- Population centres
- Major roads
- National wetlands
- Defence continuous use zone
- National, recreation and conservation parks
- Power distribution network
- Groundwater wells
- Radioactive waste storage
- Farm dams
- Airports and airstrips
- Fire history
- Prescribed well areas
- Railway

Biodiversity
- Flora
- Fauna

Hydrology and topography
- Watercourses
- Salt lakes
- Evaporation
- Springs
- Potential GDEs
- Surface water catchments
- Precipitation

Hydrogeology
(**aquifer** / *aquitard*)
- Quaternary sediments
- Tertiary sediments
- **Corraberra sandstone**
- **Woomera shale**
- **Whyalla sandstone**
- **Andamooka limestone**
- **Tregolana shale**
- *Tapley Hill formation*
- **Pandurra formation**
- *Arcoona quartzite*
- *Yarrawurta shale*
- *Basement*
- Water table
- Groundwater discharge path

Geology
- Geological structure/fault
- Adelaide Rift Complex
- Pernatty Upwarp
- Stuart Shelf
- Torrens Hinge
- Cariewerloo Basin

Research Showcase: Assessing the environmental response of the 2022-2023 River Murray flood event

The 2022-2023 River Murray flood event was the third largest flood event in recorded history in the South Australian Lower River Murray.

To understand how the environment responded to an event of this magnitude and to inform the management of future extreme events, our research teams from CSIRO, Flinders University, the University of Adelaide and the South Australian Research and Development Institute (SARDI) set out to investigate:

1. The immediate environmental impact of the flood waters in the Riverland region of South Australia, in particular the Katarapko and Pike floodplain areas
2. The environmental response to the flood event of the Coorong, Lower Lakes and Murray Mouth region, including the impacts of the flood water on marine habitats and species.

Our research found that the 2022-2023 flood event resulted in wide ranging, short-term changes in the environment, which impacted on the animals and plants living in the river and its associated floodplains and wetlands. The immediate environmental response in the Katarapko and Pike floodplain areas included reduced shallow groundwater salinities, with some saline groundwater discharging from the floodplains into the river at specific locations. Dissolved oxygen levels did not reduce to critical levels and any low oxygen events that did occur came into South Australia from further upstream.

Carp responded spectacularly to the flood event as floodplains and wetlands were inundated, creating good conditions for spawning at the right time of year. It was the largest carp spawning event seen in the Lower River Murray for over 20 years; and many thousands of carp were washed out of the Murray Mouth into the Southern Ocean, washing up on the beaches of the Fleurieu Peninsula.

A plume of freshwater extended at least 40 km into the Southern Ocean, and the reduced salinity and sediment that the flood brought to the marine environment did impact negatively on some marine organisms. The floodwaters also brought nutrients and carbon from the Murray-Darling Basin into the Southern Ocean, providing energy sources for marine plants and animals. This increased phytoplankton productivity and sparked responses up the food chain.

In the Coorong, major short-term changes associated with the large volume of fresh water passing through the barrages increased water levels and lagoon connectivity, and reduced salinity. Away from the immediate flow over the barrages, nutrients reduced and sediment quality improved. The flood event produced both positive and negative environmental responses:

Positive environmental outcomes in the Coorong following the 2022-2023 flood event:

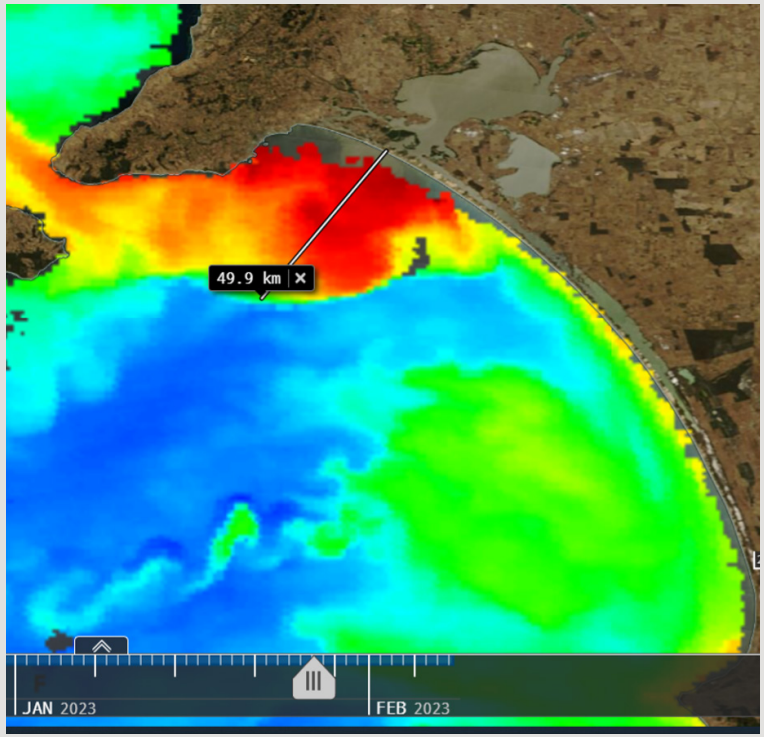
- Reduced salinity enabled increased productivity of fish and invertebrates and aquatic plants
- A greater biodiversity of plants, fish and invertebrates was found throughout the Coorong and many species became more widespread
- Large numbers of formerly widespread species also returned to the Coorong South Lagoon as connectivity and moderate conditions influenced the South Lagoon.

Negative environmental outcomes in the Coorong following the 2022-2023 flood event:

- The direct impact of physical scouring, high water levels and changing water chemistry lead to the loss of some ecosystem functions
- During periods where salinity change was dramatic, some species were not able to survive the reduction to much lower salinities, changing the composition of species in these areas with saline tolerant species being replaced by those able to tolerate much lower salinities.

Climate change is expected to result in increased frequency and duration of extreme weather events. Understanding how the South Australian Lower River Murray responded to the third highest river flows on record has been critical to help plan for an uncertain future under climate change.

Based on the observed responses to the 2022-2023 flood event, further positive responses to the Coorong ecosystem can be expected if the region experiences further moderate to good freshwater flows from the River Murray in the next couple of years. Continued freshwater flows into the CLLMM region are critical to maintain the social, cultural, economic and environmental values of the region.



Chlorophyll *a* concentrations in the Southern Ocean on 6 February 2023
(Source: NASA MODIS)

The impact of the 2022-2023 River Murray flood waters can be seen increasing photosynthetic productivity across the southern Fleurieu Peninsula and past Kangaroo Island. Yellow and red colours represent higher Chlorophyll *a* concentrations representing increased phytoplankton productivity.

Collaborating with others

We have delivered our work in collaboration with our partner organisations and many external organisations, community and First Nations representatives.

We value the contributions of all of our collaborators in 2024 which have included:

Australian Government	Department of Climate Change, Energy, the Environment and Water, National Water Grid Authority, Murray Darling Basin Authority, Commonwealth Environmental Water Holder
State governments agencies	South Australian Department for Environment and Water, South Australian Department for Energy and Mining, PIRSA/SARDI, SA Water, EPA, Infrastructure SA
Regional/local governments	Limestone Coast Landscape Board, Hills and Fleurieu Landscape Board, Murraylands and Riverland Landscape Board, Eyre Peninsula Landscape Board, Northern and York Landscape Board, Arid Lands Landscape Board, Alexandrina Council, Coorong District Council, Marion City Council
Industry, utilities, statutory bodies and communities	Aither/Ricardo, BHP, Ngarrindjeri Aboriginal Corporation, First Nations of the South East, community and industry groups within the CLLMM region and northern Eyre Peninsula region, One Basin CRC, representative groups within the Riverland region of South Australia, Desert Knowledge Australia
International organisations	Dundalk Institute of Technology (Ireland), Indigenous Services Canada, University of Otago (NZ), Victoria University (NZ) Vietnam Academy of Water Resources, Virginia Tech University (USA), Indigenous representative organisations from USA and New Zealand

Recognition of our work

Our work with Desert Knowledge Australia facilitating and delivering the national forum *Working together for better drinking water in the bush* was recognised through multiple Federal Ministerial communications from the Honourable Tanya Plibersek, Federal Minister for Climate Change, Energy, the Environment and Water.

In November 2024 the project was given a High Commendation at the Australian Water Association SA Branch R&D Excellence Award.

Interest in our CLLMM Research Centre is growing at national and international scales. We have hosted international visitors from Cambodia, China, Laos, Thailand, USA and Vietnam; as well as connecting with Indigenous representatives and organisations from Alaska, Canada and New Zealand.

Working to the future

Looking ahead, 2025 promises to be another busy year. With the Institute's current term ending in June 2026, we are already working with our partner organisations to continue the work of the Institute into a new term.

This provides opportunity for us to reflect on the great successes of the Institute and also look at where we can improve to ensure we deliver the most impactful and important water research into the future.

We will continue to deliver and promote our work as several key projects have come to an end in late 2024 or will be finishing in the first half of 2025. Our work is important to a multitude of agencies, organisations and communities and we will communicate our science and knowledge to maximise our impact.

Ensuring the sustainability of the CLLMM Research Centre is key focus over the next year, to provide confidence to community, First Nations, industry and managing agencies that their incredible investment in the work of the Centre can continue to provide the knowledge that the CLLMM region needs to address the impacts of climate change.

We will also be continuing to work to develop new partnerships and collaborations to deliver our critical work to inform water-related decision-making. This includes engaging with new organisations and agencies at state, national and international scales.

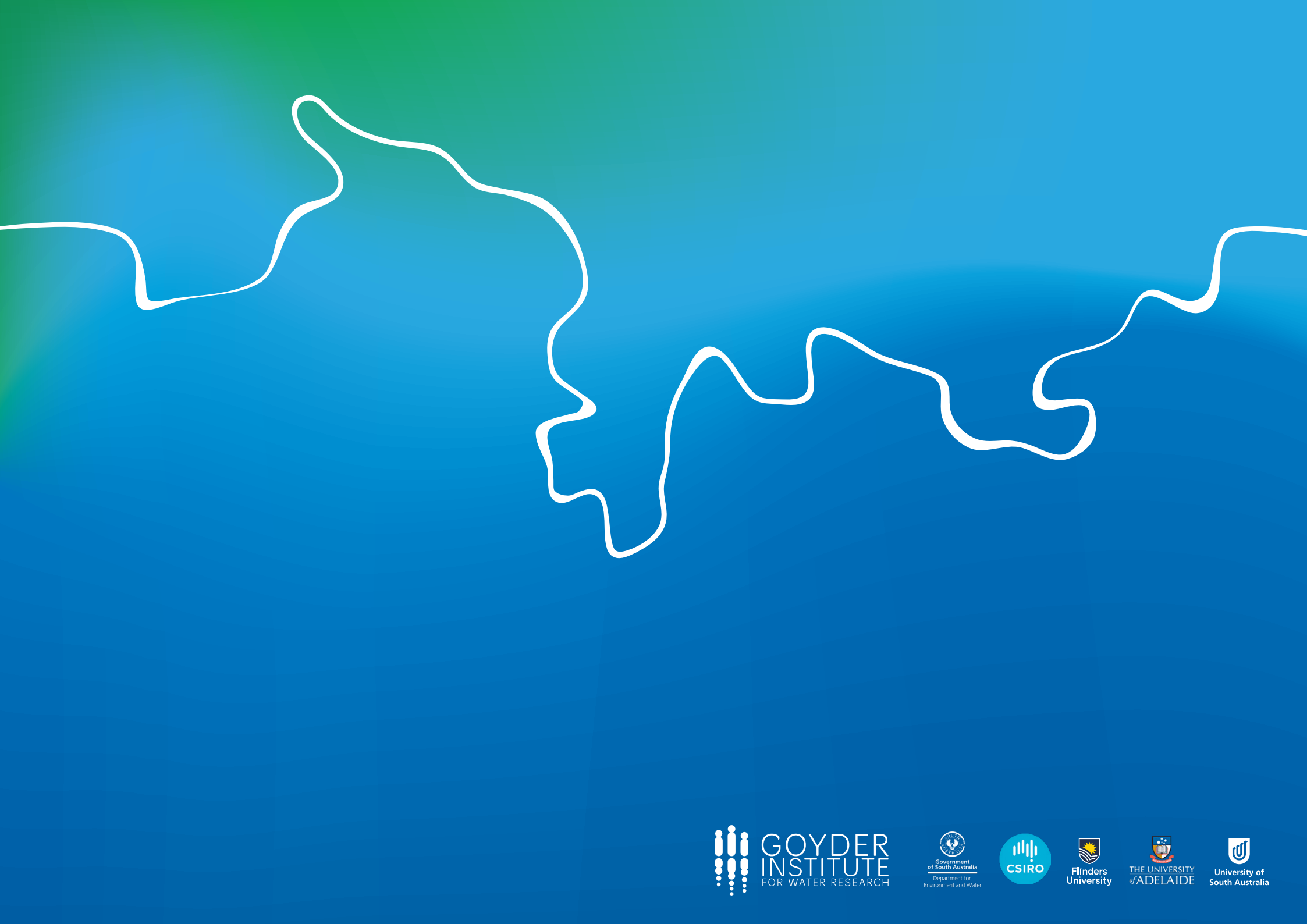
Financial statement

To ensure transparency and accountability the Goyder Institute for Water Research collaboration agreement includes a requirement for an annual audit of the Goyder Institute accounts.

The audit for the 2023/24 financial year was conducted by Messenger Zerner Chartered Accountants and an unqualified audit certificate has been provided.

Projects delivered during 2024:

Project	Funding Body
CLLMM Research Centre	Australian Government (DCCEEW)
Adaptation of the South-Eastern drainage system under a changing climate	Limestone Coast Landscape Board/Australian Government (National Water Grid Authority)
Administrative hosting of the One Basin Cooperative Research Centre Loxton Hub	One Basin CRC
Assessing the environmental response to the 2022-2023 River Murray flood event	South Australian Government (DEW)
Ecohydrological models for the Northern Eyre, Braemar and Stuart Shelf regions	South Australian Government (DEW and DEM co-funding)
Analysis of changes in high-intensity rainfall events in South Australia	South Australian Government (DEW)
Potential impacts of reducing groundwater abstraction from the southwestern Great Artesian Basin: Modelled aquifer pressure and spring flow response	South Australian Government (Infrastructure SA – Northern Waters Project)
Working together for better drinking water in the bush forum	Australian Government (National Water Grid Authority)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FOR WATER RESEARCH
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Department for Environment and Water
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Flinders University
THE UNIVERSITY of ADELAIDE
University of South Australia