

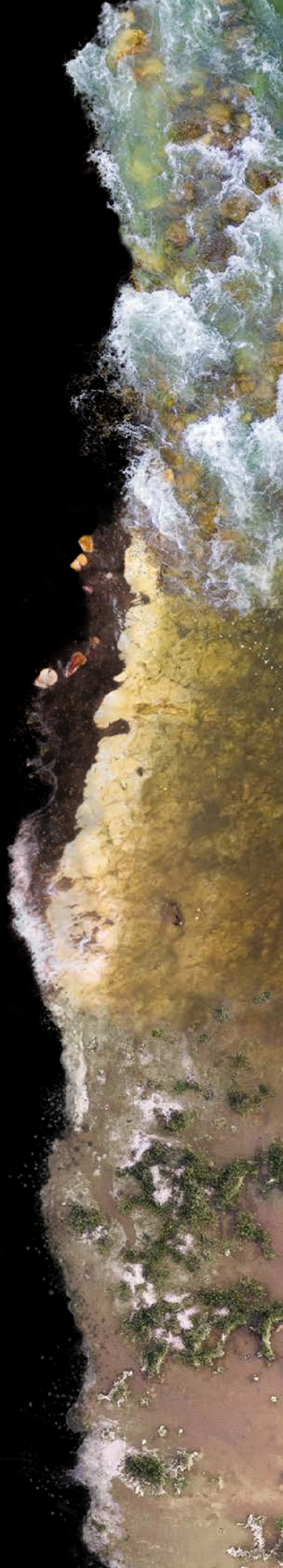


Australian
National
University

Institute for
Water Futures

Institute for Water Futures: The First Two Years

Biennial Report 2020–2021





Acknowledgement

We are grateful for financial support from the Vice Chancellor's Strategic Fund. We are proud to contribute to the delivery of the ANU Societal Transformation Plan, a framework underpinning the University's strategy.

We would like to express our appreciation for our partners, collaborators and supporters who have backed our vision and helped us as we work towards our goals.

We would like to extend a special thanks to the ANU Fenner School of Environment & Society for providing us with ongoing support and a place to call home.



We acknowledge the traditional custodians of Country throughout Australia and pay our respects to Elders past and present. We recognise the diversity of First Nations Peoples and celebrate their knowledge and ongoing connections to the land and waterways upon which we live and work.

**Institute for Water Futures:
The First Two Years**

Biennial Report 2020–2021

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Foreword

Climate change and associated extreme weather are challenging traditional approaches to water resources management in Australia and around the world. It is clear that without innovative solutions we will face increasing vulnerabilities for food security, renewable energy and drinking water. In some parts of the world, we already see how allocation disputes or lack of good quality water supply lead to conflict or chronically poor health. Many of our neighbours in the Pacific now face existential threats caused by rising sea levels, and consequently, polluted water resources.

The challenges for water resources management are front and centre. To face these challenges, we must incorporate traditional water sciences with ecological insights, economics, property rights, Indigenous knowledge and a greater appreciation for the social, cultural and spiritual benefits bestowed by water.

This integrated approach can act as a conduit for pre-emptively addressing emerging issues framed in partnership with the wider community

The ANU Institute for Water Futures provides an interdisciplinary forum for this purpose. ANU, its partners, and the wider community now have an enhanced opportunity to give future issues priority today. In this document we provide the first report of the activities of the Institute of Water Futures. We hope it not only reports on progress but encourages engagement with the Institute, for all concerned with water matters.

Professor Geoff Syme

Chair, ANU Institute for Water Futures Advisory Committee





Message from the Director

Welcome to the first biennial report of the ANU Institute for Water Futures (IWF). I warmly invite you to follow this journey through our first two years.

Complex problems do not respect disciplinary boundaries. The future of water is among the most complex challenges we face as a nation and a global community. Taking an interdisciplinary approach to the many and varied decisions on water management is not only the best way, but the only way forward.

In 2019, when the Vice Chancellor of the ANU Professor Brian Schmidt called for applications for National Institutes Grants programs to better enable the University to tackle issues of national importance, we were ready to make the case. The result — the Institute for Water Futures — is now a key part of a collective drive to make a difference on one of the most critical foundations of our environment, society and economy.

Our first two years of operation were not without difficulties. We faced devastating fires, recent severe drought, geo-political insecurity and the far-reaching effects of a global pandemic. If anything, these challenges highlighted the great need for new thinking on water and the collaborative approaches necessary to ensuring its sustainable future.

Despite the challenges, we are proud of our progress and well on the way to delivering on our mandate. **Understanding Change | Enabling Action** is not simply a slogan — it captures our core values and desires to enable, support and drive positive change in water management.

I hope you enjoy following our journey so far.

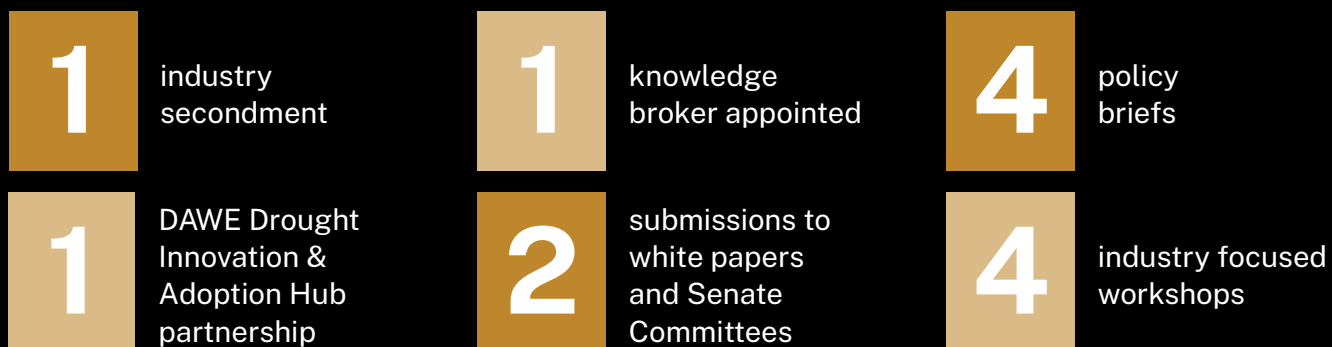
A handwritten signature in black ink, appearing to read 'Lorrae van Kerkhoff'.

Professor Lorrae van Kerkhoff

Director, ANU Institute for Water Futures

At a Glance

Impact and Engagement — Policy, Industry and Community



Synergistic Activities Across ANU

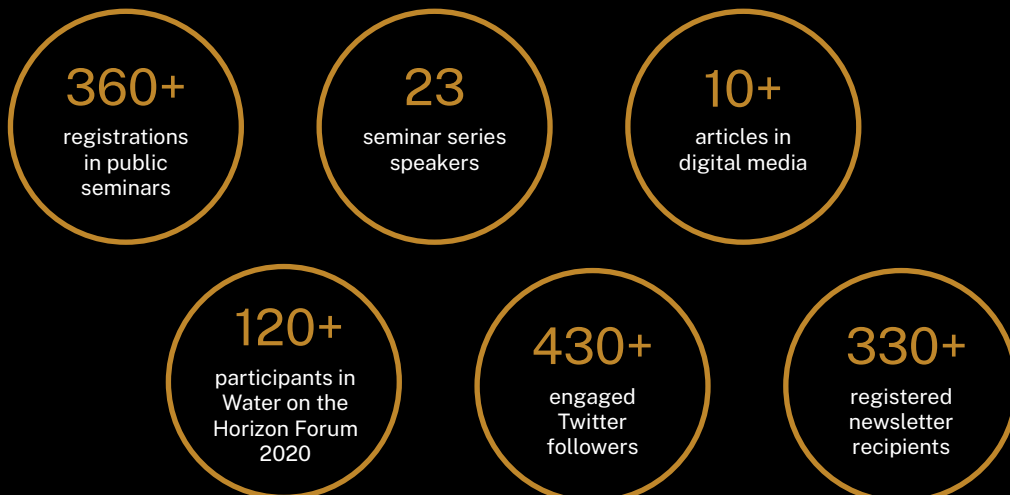


8 new cross campus research project proposal developed

7 active cross campus research projects

6 cross campus PhD supervisory panels

Outreach



External Partners and Collaboration



Education and Capability Building



20+

cross campus PhD candidates active in IWF cohort



10

courses taught by IWF fellows



120+

external participants in futuring, knowledge acquisition and exchange workshops

Indigenous Participation and Leadership



- 3 Indigenous appointments to the IWF Indigenous **Scholars Program Advisory Committee**
- 1 Indigenous appointment to the IWF **Expert Advisory Committee**
- 1 Indigenous **Scholars Program Coordinator** appointed
- 1 Indigenous **Cultural/ Artist-in-residence** appointed

1 Beginnings

In 2019, Australia was in the grips of a severe drought. The three years preceding had been some of the driest on record. In the Murray-Darling Basin, the lifeblood of Australia's agricultural sector and home to 16 Ramsar listed wetlands, flow in most of the rivers had reached record low levels, with some dried completely.

This dire situation prompted the University's leading water scientists to ask questions.

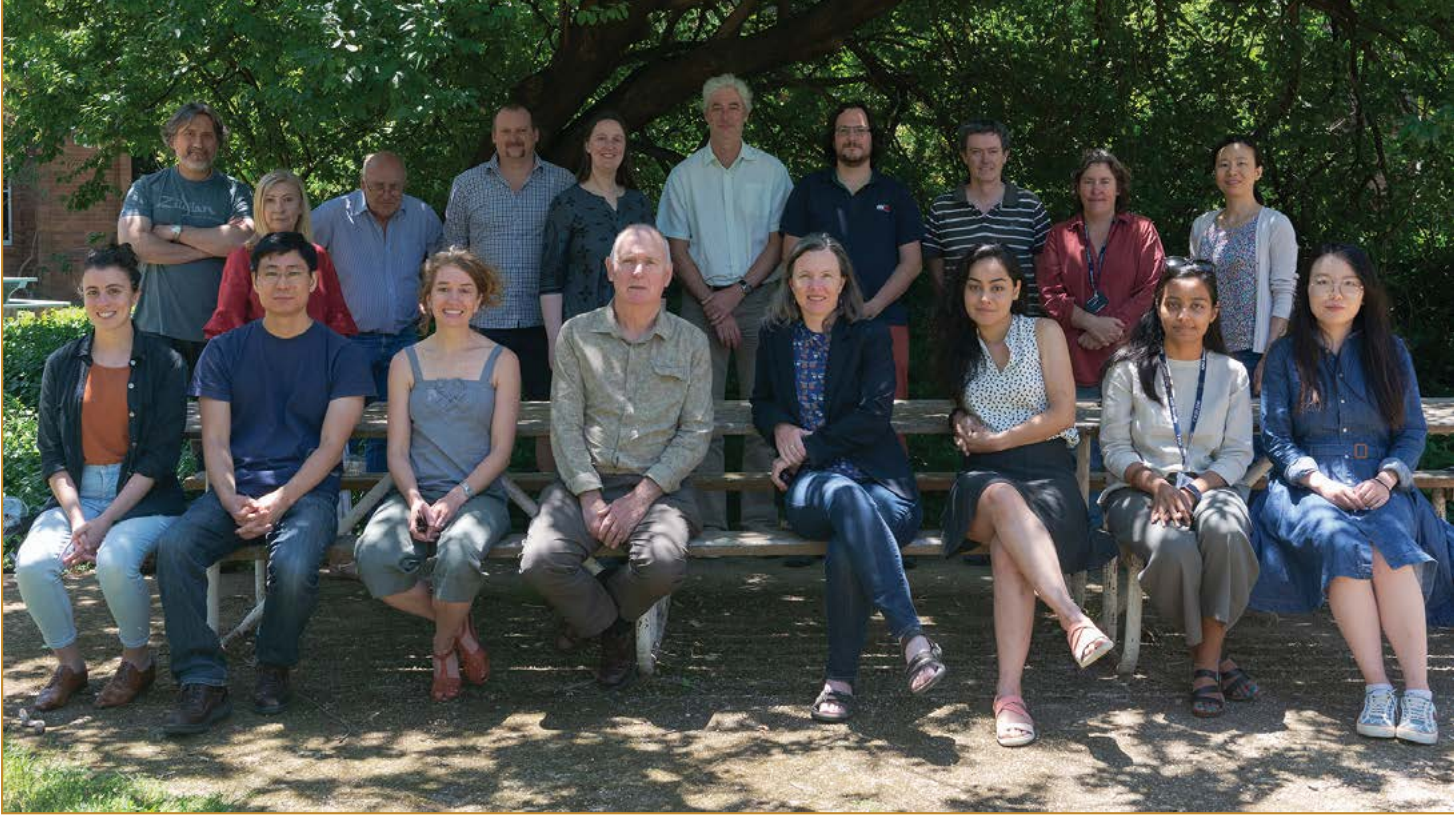
How can we safeguard our freshwater resources for coming generations? How can we guarantee fair water access for Australia's remote communities? How can we address the ecological challenges facing our rivers and wetlands? How can we support a sustainable agricultural sector? How can we ensure good water governance that anticipates changes from a warming planet? Above all, how can we plan for sustainable water futures for all?

These questions prompted a group of experts across the ANU to pursue a vision — an institute that would bring together the disciplinary strengths of the ANU to address the most pressing water issues in Australia and beyond. It would work side by side with First Nations, government agencies, civil society organisations and private sector partners to produce actionable science. It would foster shared consideration of questions around uncertain futures and how these inform today's decisions on water stewardship and management. It would collaborate with decision-makers to ensure the real-world impact of its research.

Underpinned by this vision, our institute was born. The ANU established the IWF with funding beginning on 1 January 2020. Bringing researchers from three ANU colleges, five schools and one institute together, we set about building the interdisciplinary knowledge needed to tackle the biggest issues facing water management. Recognising that actionable solutions require a collaborative approach, we sought support from external partners who were equally inspired by the need and opportunities.

Despite pandemic-related disruptions, we dived headfirst into a busy schedule of research projects, events and activities designed to work towards our vision.

Two years on and while the recent drought has subsided, extreme weather and geopolitical uncertainty have driven home the fact that now more than ever, the just and sustainable stewardship of water will be key to all of our futures.



The IWF team (December 2020). Front row (left – right): Hannah Feldman, Takuya Iwanaga, Carina Wyborn, Anthony Jakeman, Lorrae van Kerkhoff, Mahdiyeh Razeghi, Raktima Dey, Siyuan Tian. Back row (left – right): Luigi Renzullo, Susan Ward, Matthew Colloff, Paul Wyrwoll, Katherine Daniell, Paul Tregoning, Joseph Guillaume, Barry Croke, Wendy Merritt, Baihua Fu. Source: Ian Skinner

People

The development of our institute was led by senior representatives at our partner schools and institutes; the ANU Crawford School of Public Policy, ANU Fenner School of Environment & Society, ANU Research School of Earth Science, ANU College of Engineering & Computer Science, the ANU Mathematical Science Institute, and the ANU Institute for Climate, Energy & Disaster Solutions. These global thought-leaders make up the IWF Leadership Group and meet monthly to oversee our direction and strategy.

The new strategic funding from the ANU allowed us to hire energetic Research Fellows to focus on our work. Fellows are based at host schools and institutes, a structure designed to promote cross-campus collaboration.

First on board were Associate Professor Carina Wyborn, a qualitative social scientist; Dr Joseph Guillaume, an interdisciplinary modeller; and Dr Luigi Renzullo, a hydrological modeller, all from the Fenner School of Environment & Society. We then welcomed Dr Paul Wyrwoll, a water economist at the Crawford School of Public Policy; Dr Mahdiyeh Razeghi, a geodesist

at the Research School of Earth Sciences; and Hannah Feldman, a social scientist seated at the School of Cybernetics.

Also joining the broader team were existing ANU researchers with expertise and interest in water futures, attracted by our values and mission. These researchers are actively involved with our work but also engage with separate ANU and external projects. We also invited a number of IWF associates – academics and practitioners from across campus and beyond to engage with our activities.

In addition to our academic staff and associates, four professional staff have joined our team. These staff are the engine room of IWF activities – driving operations, program coordination, communication, events and knowledge brokering.

Now a solid team of fellows, leadership advisors, research staff, associates and professional staff, we bring together expertise from schools and institutes across the ANU, making the IWF a truly university wide endeavour.

Leadership Group



Professor Lorrae van Kerkhoff is the Director of the ANU Institute for Water Futures and the Associate Director of Staff Development at the ANU Fenner School of Environment & Society. Her research focuses on understanding the role of science in decision-making for complex environmental issues, especially with regard to preparing for uncertain but different futures. Lorrae is internationally renowned for her expertise in collaborating with stakeholders to generate innovative pathways for transition and transformation.



Professor Katherine Daniell is a trans-disciplinary academic at the ANU School of Cybernetics and the ANU Fenner School of Environment & Society. Katherine's work focuses on collaborative approaches to policy, action and education for sustainable development. She has worked in Europe and the Asia-Pacific on projects related to international science and technology cooperation, water governance, risk management, sustainable urban development, politics and cultures of innovation, and climate change adaptation. Katherine is currently President of the Australian-French Association for Research and Innovation (AFRAN) Inc, a member of the National Committee on Water Engineering (Engineers Australia) and a Director of the Peter Cullen Water and Environment Trust.



Professor Quentin Grafton is an economist, Australian Laureate Fellow, and Convenor of the Water Justice Hub at the Crawford School of Public Policy at ANU. He was recently appointed to be a Lead Expert and Commissioner of the Global Commission on the Economics of Water. He is a Fellow of the Academy of Social Sciences in Australia and a Distinguished Fellow of the Australasian Agricultural and Resource Economics Society. In April 2010 he was appointed (and remains) the Chairholder, the UNESCO Chair in Water Economics and Transboundary Water Governance. He currently serves as the Director of the Food, Energy, Environment and Water Network. His collaborative research, as part of the IWF, is focused on drinking water quality and water planning in the Northern Murray-Darling Basin.



Professor Mark Howden is Director of the ANU Institute for Climate, Energy & Disaster Solutions. Mark has worked on climate variability, climate change, innovation and adoption issues for over 30 years in partnership with many industry, community and policy groups via both research and science-policy roles. A Vice Chair of the Intergovernmental Panel on Climate Change (IPCC), he has been a major contributor since 1991, with roles in the Second, Third, Fourth, Fifth and Sixth Assessment Reports, sharing the 2007 Nobel Peace Prize with other IPCC participants and Al Gore.



Professor Tony Jakeman is an environmental scientist and modeller with over four decades of experience and over 450 publications in open literature. Tony was instrumental in the establishment of the IWF, leads the Integration and Decision Support Program of the National Centre for Groundwater Research and Training and directs the iCAM Centre. His work has pioneered the development of integrated assessment methods and decision support systems for water and associated resource problems.



Professor Stephen Roberts was the head of the ANU Department of Mathematics from 2006–2012. His research focus is the application of efficient and robust numerical methods for the solution of partial differential equations. He is the University's lead developer of the ANUGA hydrodynamic flooding and tsunami modelling software – an open source computational tool that models the impact of dam breaks, floods and tsunamis on communities.



Professor Paul Tregoning is a geophysicist who uses space-geodetic observations to study changes in the Earth caused by different geophysical processes such as tectonic deformation, climate-driven variations in sea level and polar ice caps and tidal deformation. He is the Head of Climate, Ocean and Geoscience and Head of the Geodesy group at the ANU Research School of Earth Sciences, an InSpace Mission Specialist (Earth Observations) and an editor of the Journal of Geophysical Research – Solid Earth.



Professor Albert Van Dijk established and leads the Centre for Water & Landscape Dynamics at the Fenner School of Environment and Society. The author of more than 130 publications, his research addresses the interaction between vegetation and the hydrological cycle and related processes, such as soil erosion, nutrient cycling, salinity, the surface energy balance, the carbon cycle, fire risk, biodiversity, ecological resilience, and crop growth. Professor Van Dijk was an inaugural co-chair of the Australian Energy and Water Exchange Initiative (OzEWEX).

Research Fellows

Dr Joseph Guillaume

ANU Fenner School of Environment & Society

Dr Mahdiyeh Razeghi

ANU Research School of Earth Sciences

Dr Luigi Renzullo

ANU Fenner School of Environment & Society

Associate Professor Carina Wyborn

ANU Fenner School of Environment & Society

Dr Paul Wyrwoll

ANU Crawford School of Public Policy

Hannah Feldman

ANU School of Cybernetics

Research Staff

Dr Baihua Fu

ANU Fenner School of Environment & Society

Dr Serena Hamilton

ANU Fenner School of Environment & Society

Dr Jiawei Hou

ANU Fenner School of Environment & Society

Dr Takuya Iwanaga

ANU Fenner School of Environment & Society

Dr Steven Lade

ANU Fenner School of Environment & Society

Dr Wendy Merrit

ANU Fenner School of Environment & Society

Dr Siyuan Tian

ANU Fenner School of Environment & Society

Dr Katherine (Kat) Taylor

ANU Crawford School of Public Policy

Dr Ana Manero

ANU Crawford School of Public Policy

Associate Professor Barry Croke

ANU Fenner School of Environment & Society
and ANU Mathematics Sciences Institute

Professional Staff

Susan Ward

Institute Manager

Erin Neil

Communications Officer

Dr Anita Peerson

Knowledge Broker

Hayley Primrose

Indigenous Scholars Program Coordinator

Advisory Committee

In 2021 we appointed our first Advisory Committee. A group of independent and international experts, the IWF Advisory Committee members bring a depth of knowledge and experience from a range of industry, academic and advocacy roles.

The Committee continue to gather virtually on a regular basis to evaluate priorities and advise on strategy and direction, helping to position us as a world-leading research institute.



Chair

Professor Geoffrey Syme

Edith Cowan University and Editor in Chief of the Journal of Hydrology

Members

Emeritus Professor Howard Wheeler

University of Saskatchewan

Dr Anna Roberts

Natural Decisions Pty Ltd

Professor Louise Heathwaite

Lancaster University

Associate Professor Dustin Garrick

University of Waterloo

Professor Karen Willcox

University of Texas

Dr James Horne

James Horne & Associate Former Deputy Secretary in the Australian Department of Sustainability, Environment, Water, Population and Communities

Professor Katharine Jacobs

University of Arizona and Director of the Centre for Climate Adaptation Science and Solutions

Ms Rhonda Robinson

SPC, SOPAC Division, Deputy Director for Water & Sanitation Program

Associate Professor Eduardo Araral

NUS, Institute of Water Policy, Vice Chairman of the Asia Pacific Water Forum

Mr Greg Claydon

National Water Reform Committee

Dr Anne Poelina

Madjulla Inc, Martuawarra Fitzroy River Council, Notre Dame University

Strategy



The IWF Leadership Group was quick to start planning the strategy to achieve our vision. Over the course of two years, through a consultative process involving our researchers, Leadership Group and Advisory Committee, associates and partners, we co-designed the [IWF Strategic Plan](#)¹. The plan aims to guide our research agenda through a clear vision, set of values and areas of focus.



Our Vision

Understanding change | Enabling action

Sustainable and just water futures for all, empowered through collaboration, innovation, integrity and influence.



Our Values

Innovation | Integrity | Influence

We support the diverse social, cultural, environmental and economic values of water. We integrate these values across our programs, guided by principles of interdisciplinarity, collaboration with partners and communities, mutual learning and respect.



Focus Areas

Strategic intent

We engage with partners from diverse contexts in ways that reflect the specific needs and challenges of that community, enterprise, landscape or region. Place-based research is seen as essential to resolve contextual water problems and accrue the learnings for assessing water futures more widely across the globe.

- Australia — National
- Murray-Darling Basin
- Great Barrier Reef catchment
- Indigenous-led initiatives
- Indo-Pacific region
- Global engagement

¹ waterfutures.anu.edu.au/about/our-goals



Indigenous Initiatives

We celebrate the ancient knowledge of First Nations People and are committed to incorporating Indigenous expertise in managing Australia's waterways for the years to come. To this end, championing Indigenous scholars and amplifying Indigenous voices in the water sector is an important aspect of our work.

Since 2020, we have worked to establish the IWF Indigenous Scholars Program (ISP). The program aims to attract and support Indigenous Scholars with interests in water by assisting students to enter tertiary study, successfully complete their studies, gain related employment and continue alumni contact with ISP graduates. The first IWF Indigenous Honours scholarships will open to students in 2022 for commencement in 2023.

In 2021, we appointed an ISP Coordinator — a role responsible for recruiting and empowering Indigenous students to take control of their studies and future careers. The ISP Coordinator acts as a first point of call for ISP students to navigate the ANU environment, connect with appropriate supervisors and access exciting project opportunities.





Historical Brewarrina Aboriginal fish traps on the Barwon river in the far northwest of New South Wales. Credit: John Carnemolla

Indigenous Scholars Program Advisory Committee

The Committee was appointed in 2020 and meets monthly to provide strategic oversight and practical advice on the program. While no longer on the committee, Dr Virginia Marshall was a driving force behind the development of the first ISP strategy. We are grateful for the time and efforts of the Advisory Council and its supporters.

The current Advisory Committee members are:

Hmalan Hunter-Xenie is of Tiwi/Iwaidja and Kaytej/Warlpiri descent (Northern Territory, Australia) and Drehu descent (Lifou Island, New Caledonia) and recently completed ANU Honours project titled *'More Than a Human GPS? Opportunities for Aboriginal Peoples to Lead and Manage Land and Water Research On-Country in the Northern Territory, Australia'*.

Minda Murray is a proud Yorta Yorta Duduroa woman and a First Nations Academic Associate at ANU. Minda is completing a PhD in Aboriginal Self-determination and agreement making in her home state of Victoria.

Emeritus Professor Richard Baker has spent a professional lifetime at the ANU, and as Pro Vice-Chancellor (University Experience), he championed outcomes to support student and staff equity, Indigenous Reconciliation and the student experience.

Associate Professor Bill Fogarty is the Deputy Director of the Centre for Aboriginal Economic Policy Research at ANU. He has lived and worked in remote communities for over 20 years and has extensive experience in research on Indigenous education, employment policy and service provision.

Cultural Residency

In 2021 we designed the IWF cultural residency, a first-of-its-kind program at ANU. Based loosely on the concept of an artist-in-residence, the cultural residency is a one-year program that draws on the process of creating art along with stimulating dialogue to foster cross-cultural understanding of Indigenous peoples and cultures.

In 2022, we appointed the first IWF Cultural Resident Reverend Glenn Loughrey. Wiradjuri man, artist, writer and Anglican Priest, Glenn now works with our researchers and partners to unpack decoloniality. This learning is a first step to understanding how Indigenous and non-Indigenous communities can move forward together and how we can bring this awareness to our research.



Source:
David
Merrylees

Credit: Samantha Vilkins

While we have much work to do, we are proud to support First Nations' knowledge and students as a pillar of our Institute.

Partners

We are focused on building strong relationships to shape discourse on water futures and grow capability for future-oriented decision making.

The following partners supported the original proposal to establish the IWF, and we are grateful for their ongoing engagement.

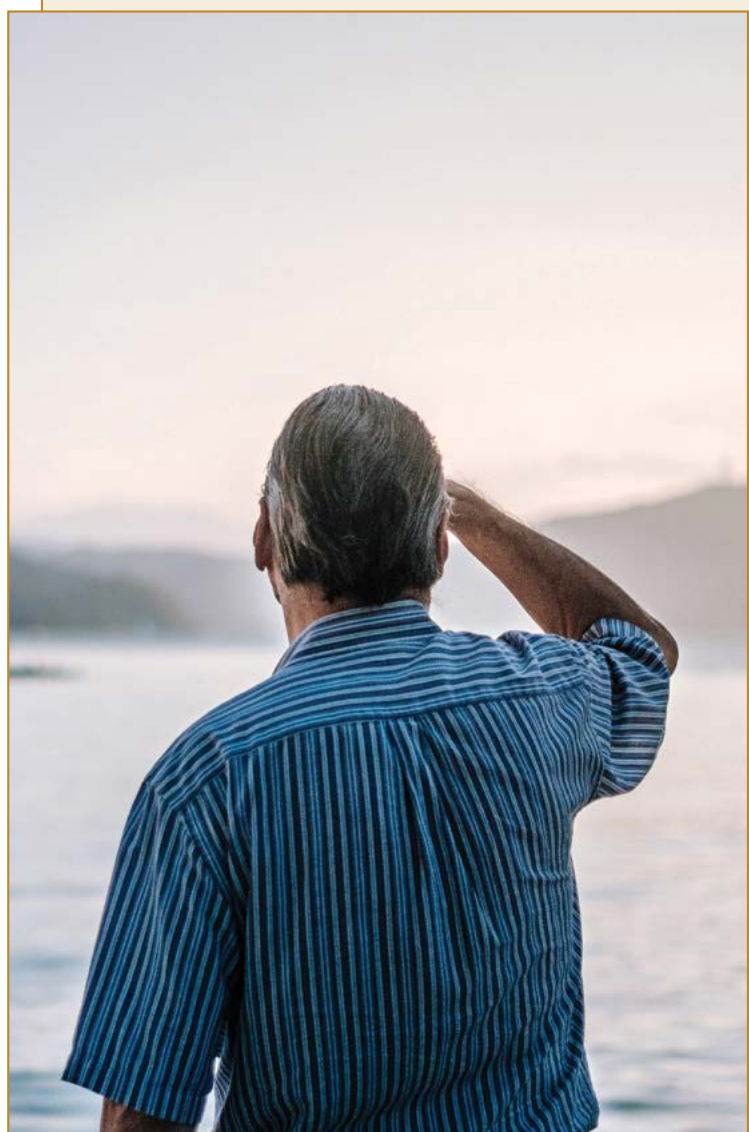
1. Bureau of Meteorology (BoM)
2. Commonwealth Scientific and Industrial Research Organisation (CSIRO)
3. Atlas of Living Australia (ALA)
4. Geoscience Australia (GA)
5. Murray Darling Basin Authority (MDBA)
6. NSW Department of Planning Industry Environment (NSW DPIE)
7. Office of Water Science – Department of Agriculture, Water and the Environment (DAWE)
8. QLD Department of Environment and Science (QLD DES).

Since our establishment, the Institute has continued to develop new key strategic partnerships. Today we are happy to add the following organisations to our list of active partners.

9. Australian Institute of Marine Science
10. Icon Water
11. WaterTrust Australia.

We also recognise the importance of incorporating Indigenous experience in water resource planning today and in the future. With the support of the ANU Water Justice Hub, we have begun to make connections with Indigenous communities in the Kimberley and Murray Darling Basin regions. These connections aim to further our commitment to supporting First Nation's peoples to bring traditional knowledge to discussions and decisions on water matters.

6



Credit: Yannes Kiefer

Collaboration Highlights

Our institute is dedicated to bringing different voices and experiences together so we can tackle the challenges of achieving the futures we want, while maintaining focus on what we can do “here and now” to work towards those futures. With this in mind, collaborations and partnerships are a key part of our work.

Building Drought Resilience



Credit: Red Charlie

In 2021, we became a tier one partner of the Southern NSW Drought Resilience Adoption and Innovation Hub, also known as the SNSW Hub. Established through the Federal Government’s Future Drought Fund, the SNSW Hub is one of eight regional hubs responsible for helping farmers and rural and regional communities build drought resilience. A consortium of primary producers, grower groups, industry, researchers, entrepreneurs, education institutions and governments, the SNSW Hub undertakes co-designed and demand driven drought resilience research, development, extension, adoption and commercialisation. Through its work, it provides communities with the tools, practices and confidence to manage through periods of drought in the future. IWF Director, Lorrae van Kerkhoff, sits on the SNSW Hub Board.

As part of our involvement, we appointed a Knowledge Broker who works with ANU researchers to facilitate relationship-building and research projects with SNSW Hub partner agencies and within local communities. This is a joint appointment with the ANU Centre for Entrepreneurial Agri-Technology (CEAT).

The Great Barrier Reef vs Climate Change

The Reef Restoration and Adaptation Program for the Great Barrier Reef (GBR) is a collaboration led by the Australian Institute of Marine Science and funded by the Great Barrier Reef Foundation. The program aims to plan and develop a suite of interventions to keep the GBR resilient in the face of climate change. Our institute is a part of the team of ecological and oceanographic modellers, mathematicians and decision scientists tasked with developing and applying decision-support tools for the project, including the key Adaptive Dynamic Reef Intervention Algorithm (ADRIA). These tools will help identify solutions for interventions under different climate change scenarios.



Credit: Daniel Pelaez Duque



The Gilbert River catchment in Far North Queensland taken during fieldwork.

Credit: Dr Wendy Merritt

Gilbert River

The Queensland Water Modelling Network (QWMN) Gilbert River project is part of a cluster of work that has built our critical mass in research on water management in Queensland. We work with Gulf Savannah NRM, Etheridge Shire Council (ESC), Regional Development Australia Tropical North (RDATN), and the water planning section of the Department of Regional Development, Manufacturing and Water (RDMW). Our collaborative projects help to increase local engagement in water management and contribute to agricultural development and economic diversification in Far North Queensland.

Our involvement includes action research that prototypes the use of digital twins to engage and integrate knowledge about the region. We expect the approach will be scaled out to other NRM regions, and that our project will influence the review of the existing water plan.

8 Our Work

Our researchers lead cutting edge work exploring all aspects of sustainable water futures. Here is a snapshot of recent highlights.



Associate Professor Carina Wyborn led a three-year study examining productive collaborations between researchers, government, practitioners and community groups. The study resulted in two papers, one published in Nature journal, exploring what makes ‘good’ collaboration between science and policy for real world impact.



In her recently submitted PhD, **Hannah Feldman** investigated how young people engage with a changing climate through political action. Hannah explored how and why teenagers end up forming events such as #climatestrike, and what happens when politicians tell them to “go back to school”...



Designed to anticipate threats to ecosystems, **Dr Jiawei Hou** developed algorithms to estimate water volume dynamics using Landsat and airborne LiDAR observations. This work has game-changing implications for improving how floodplain ecohydrology is represented in the computer models that underpin water sharing.

Dr Steven Lade won a grant from the Icon Water and ActewAGL Endowment Fund. These funds will support a student to examine the resilience of ACT’s catchments, supporting IWF engagement with Canberra’s local water operator.



Dr Paul Wyrwoll published a paper exploring the possibilities of harnessing hydropower reservoirs to adapt to climate change and outlining policy reforms that could be applied to dam developments in the Murray-Darling Basin and Great Barrier Reef catchments.



Dr Baihua Fu led a group of researchers, in collaboration with the QLD Government, to develop four 2050 water management scenarios for the South East Queensland and Mary River region. These scenarios were used to stress-test current strategies and workshop roadmaps to desirable futures.





In a collaborative project between ANU and Bureau of Meteorology (BoM), **Dr Siyuan Tian** and **Dr Luigi Renzullo** investigated the assimilation of satellite soil moisture into the operational water balance modelling system and explored the potential for improving flood forecasting.

To build upon this partnership, **Dr Luigi Renzullo** was appointed a one-year secondment at BoM, beginning in 2022. During his secondment, Luigi is tasked with applying his expertise in satellite earth observations to the parametrisation and optimisation of the land surface model. This will soon be the model underpinning BoM's services to deliver water budget information for Australia.



To support the restoration and adaptation of the Great Barrier Reef, **Dr Takuya Iwanaga**, together with the Australian Institute of Marine Science, led the development of a decision support system to investigate intervention options.

Dr Mahdiyeh Razeghi

continued her ground-breaking work combining geodetic satellite data sets with in-situ observation to study groundwater evolution over Australia's basins. Collaborating with Virginia Tech University, Geoscience Australia, and Bureau of Meteorology, she submitted a paper on changes in groundwater storage in the Lachlan Catchment based on observations of surface deformation and groundwater level data.



Dr Wendy Merritt and **Dr Serena Hamilton** led a part of a project on promoting socially inclusive and sustainable agricultural intensification in West Bengal and Bangladesh, resulting in two journal articles on marginalised farmers access to and stewardship of freshwater resources.

Dr Wendy Merritt and **Dr Joseph Guillaume's** research in the Gilbert River catchment in Far North Queensland investigated innovative storage options and knowledge governance to address water availability issues common in the dry season.

Dr Joseph Guillaume also led a team to create a website that brought together theory, software and case studies about decision making in the face of multiple plausible futures, with a focus on water modelling and management. Funded by Queensland Water Modelling Network Small Grants Program 2020, the team designed the site to be a community and educational resource in futures thinking.



Project Highlights

We lead a range of futures-focused research projects to improve knowledge, capability and governance in the water sector. Two of these projects are profiled in this section.

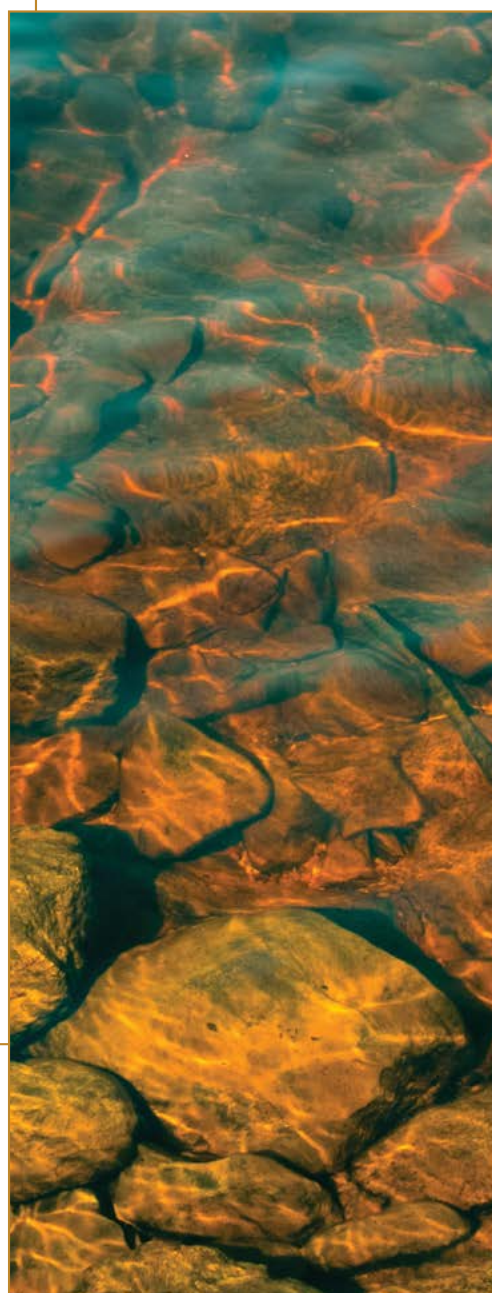
Queensland Water Management in 2050

Using foresight methodologies, IWF researchers seek to help people think differently about the medium to long-term future of water management in Australia.

Current water and riverine ecosystem monitoring and modelling approaches are useful in providing insight into past and emerging trends in water and riverine ecosystems, however they are ill-equipped to predict how the environment will respond to a wider range of accelerating changes likely in the future, under the effects of changing climate (including climate extremes), land-use, agricultural and energy markets, tourism, and multi-cross-sectoral policies.

Supported by funding from the Queensland Water Modelling Network, Dr. Baihua Fu led a collaborative team from the IWF to develop processes and tools that support the co-creation (with State government, industry and community) of possible futures for Queensland's water resources and related ecosystems. The team aims to identify opportunities and interventions to move towards desirable outcomes in water and associated resources under these scenarios.

The project has focused on the Mary River and South East Queensland catchments but has the potential for expansion on a national scale.



Credit: Steve Huntington

Social Responsibility of Algorithms and AI

Are we moving into a new age of water sector management with the help of artificial intelligence (AI)? As with any technology, AI presents exciting opportunities but also dangers. With real concerns around privacy, decision autonomy, fairness and interpretability, how can we shape the creation of socially responsible algorithms?

Through case studies, our researchers explore what responsible algorithmic development and policy-making might look like in light of socio-economic and environmental uncertainties. The project focuses on relevant upcoming governance challenges and opportunities in the European Union and Australia.

Multi-disciplinary teams from the IWF work within the ANU Algorithmic Futures Policy Lab (AFPL) to catalyse pathways to successfully design technology and policy for an uncertain future, including in the water sector.

Professor Katherine Daniell, Dr Joseph Guillaume and Hannah Feldman are currently working on the Social Responsibility of Digital Agriculture case study, exploring the role of technology in irrigated agriculture (also termed agriculture 4.0, smart farming, and digital agriculture). The team worked on a podcast series, including [one episode](#)² speaking about the lived experiences of irrigation modernisation together with analysis of system-wide change in the Murrumbidgee region.

² algorithmicfutures.org/episode-7/



Credit: Pavel Danilyuk

10

Students

In 2021, we began rolling out the IWF PhD program, designed to provide an outstanding PhD experience for a growing student cohort under IWF researcher supervision.

This program aims to build an interdisciplinary research culture and arm students with awareness of key elements of water futures, as well as to provide professional development opportunities and strengthen capabilities to engage in complex problem solving. This program is unique in concept and supplementary to other activities offered by other ANU colleges and schools.

We held the first student workshop in August 2021. Students shared their research topics and backgrounds and scoped thematic groups with the cohort. They also workshoped what they wanted to see from the IWF PhD program as well as what they could give back.

This workshop provided valuable insights as our student cohort grows and we continue to build our program.





“ It is an amazing and excellent experience in taking part in the IWF PhD program. The IWF PhD students are very friendly, social, collaborative and share the existing resources — be it new scientific papers, skill development workshops, Post-doc calls — with the other colleagues to best utilise information and knowledge for PhD study and beyond.”

— Md Kamruzzaman, IWF PhD candidate



“ This is an exciting time to be part of the IWF PhD cohort. We are working on ways to bring IWF PhD candidates together more as a community and we have had an increasing number of opportunities to discuss our research and develop skills.”

— Leila Noble, IWF PhD candidate



Outreach

In early 2020, we set out to build a program for outreach and engagement. The pandemic disrupted many of our in-person event plans, leading us to pivot to a hybrid or online only format for many of our activities.

An early priority was creating a visual identity and digital media channels. We began work on our website and created a social media presence via Twitter, followed by LinkedIn and YouTube. We needed to adapt to changes to the University's branding, but as we approached the end of 2021, we were proud to see a suite of IWF assets that reflected our vision, values and place at ANU.

In Semester 2 2020, we launched the IWF seminar series. These regular, online presentations were a chance for our research team to share their latest work with the wider IWF community. As time went on, we invited guests from further afield to present their research. With the backdrop of remote work and social distancing, the seminars were an opportunity to come together, albeit virtually, to explore connections across the IWF and beyond.

In December 2020, we held the inaugural [Water on the Horizon \(WOTH\) Forum](#)³, a 'horizon scan' of the status and trends that will impact Australia's

water futures. With a focus on the Murray-Darling Basin, the two-day event offered online and hybrid sessions exploring key issues shaping the future of water and local communities. The event included four targeted workshops involving partners and associates and two public events featuring panellists from across the University and partner agencies. The forum saw over 120 participants involved in the workshops, and over 360 registrations for the public panel discussions.

The WOTH 2020 Forum also included the official IWF launch event. With thought-provoking speeches from Director Professor Lorrae van Kerkhoff and Leadership Group member Professor Mark Howden, the event was a chance to come together to reflect on the year that had been and exciting plans for the years to come. ANU Chancellor Brian Schmidt, while not able to attend in person, filmed a [special video](#)⁴ that was screened during the event. The launch was attended by senior representatives from the University, government and industry. We were graciously welcomed to Country by Paul House from the Ngunnawal and Ngambri communities.

³ waterfutures.anu.edu.au/news-events/news/event-summary-water-horizon-forum-2020

⁴ www.youtube.com/watch?v=tjwSN53kylw



IWF team members (left – right): Paul Wyrwoll, Joseph Guillaume, Katherine Daniell, Carina Wyborn and Baihua Fu in a WOTH 2020 workshop. Source: Ian Skinner



Professor Mark Howden speaking at the Institute for Water Futures launch event in December 2020.

Source: Ian Skinner

In the policy space, 2021 kicked-off with an IWF submission on water reform to the Productivity Commission Review led by Professor Quentin Grafton and Dr Matt Colloff. Later that year, Dr Matt Colloff together with Professor Jamie Pittock also led a submission to the Senate Committee on the Multi-Jurisdictional Management and Execution of the Murray-Darling Basin Plan.

We also created [several policy briefs](#)⁵, helping to translate our research into action. The briefs include “Ecological character of Ramsar wetlands”, “Threatened species left high and dry”, “A trickle, not a flood” and “Investing in river health”.

In terms of public debate, our researchers co-authored a number of articles in The Conversation including [‘You wake up with lab-engineered coffee’: how our imaginations can help decide Earth’s future](#)⁶, [Australia, it’s time to talk about our water emergency](#)⁷, [A major scorecard gives the health of Australia’s environment less than 1 out of 10](#)⁸, and [To predict droughts, don’t look at the skies. Look in the soil... from space](#)⁹.

In the podcast space, Professor Lorrae van Kerkhoff was interviewed on the [‘Take me to the river’ podcast](#)¹⁰ where she shared her thoughts on why thinking about the future is hard, and the importance of institutional environments that allow for uncertain futures.

5 waterfutures.anu.edu.au/research/policy-briefs

6 theconversation.com/you-wake-up-with-lab-engineered-coffee-how-our-imaginations-can-help-decide-earths-future-145167

7 theconversation.com/australia-its-time-to-talk-about-our-water-emergency-139024

8 theconversation.com/a-major-scorecard-gives-the-health-of-australias-environment-less-than-1-out-of-10-133444

9 theconversation.com/to-predict-droughts-dont-look-at-the-skies-look-in-the-soil-from-space-110493

10 arcc.com.au/take-me-to-the-river-episode-9-why-is-thinking-about-the-future-hard-with-lorrae-van-kerkhoff/



Professor Lorrae van Kerkhoff records a podcast with Dr Siwan Lovett from the Australian Rivers Restoration Centre

Source: Australian Rivers Restoration Centre website

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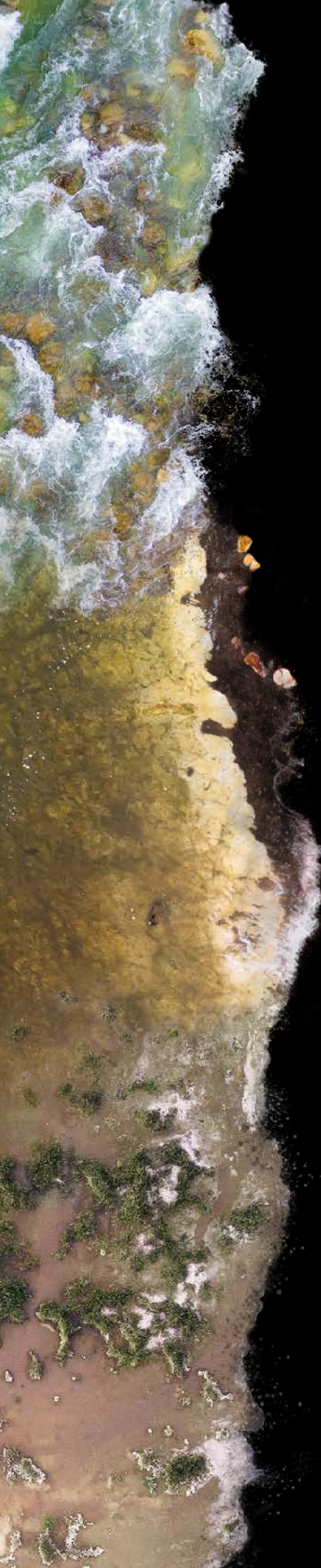
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