Research Priorities and Prospectus

Version 2.0 | March 2025

Water Research AUSTRALIA

Supply Optimisation

Service Delivery

Circular Economy

Liveability

Workforce

Water Research Australia's **Research Priorities and Prospectus** provides clear direction for collaboration and co-investment in research and innovation across the water industry.

Updated in March 2025, this second edition reflects the evolving challenges and opportunities facing the sector, ensuring our research priorities remain relevant and impactful.

By connecting members with leading national and global expertise, WaterRA helps the sector prepare for and respond to emerging challenges—ensuring the sustainable management of catchments, networks, and treatment processes to safeguard human health and the environment.

This prospectus is more than a document—it's an invitation. An opportunity to collaborate on shared priorities, form strategic partnerships, and invest in high-impact research that delivers real-world solutions for the water sector.

Supply Optimisation Research Program

Making all water supply options safe and reliable

As the water industry shifts away from a reliance on rainfall dependent, surface water supplies and towards more diverse supply options an evidence-based, research led approach is required on all available and fit-for-purpose options.

The provision of adequate treatment solutions for water and wastewater is challenging in the face of ever-growing lists of contaminants of emerging or emerged concern. WaterRA and its BIG Team can provide the leadership required to validate and advance innovative treatment and delivery options to improve security of supplies.

Drivers for research in this area include:

- The need for safe, sustainable, and affordable fit-for-purpose use of different water sources and supplies.
- New developments in the water industry's social licence to operate diverse water treatment and delivery options.
- Enabling One Heath through integrated and unified approaches to safe water delivery
- Increasing public pressure and expectation for the water industry to maintain effective control and response to addressing contaminants of potential, emerged and emerging concern.
- The need for reliable and nationally standardised water treatment validation processes

Research Program Focus Areas

One Health: Optimising Health for People, Animals and our Environment

Contaminants of Emerging and Emerged Concern (CECs): balanced risk assessment and management approaches

Treatment Technologies and Approaches

Disinfection: Effective treatment outcomes, including management of Disinfection By-Products Algal innovation: Proactive management of cyanobacteria and algal blooms

Alternative Water Sources: Fit-for-purpose solutions across the water portfolio

Algal Innovation

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
WATER TREATMENT TECHNOLOGIES AND PROCESS EVALUATION Our goal is to equip our members with knowledge of the most innovative management and treatment approaches to successfully respond to water security and water quality challenges.	1 **Development of a viable solution for barrier integrity testing to replace MS2 and confirm virus and other pathogen removal.**	Underway: #2070 - ClearPathogen: Real Time Validation of Barrier Integrity in Water Treatment (RFF open)
	1 **Exploring and assessing advances in Nanobubble technology for water treatment applications.**	Underway: #1142 – ARC - Assessing the Efficiency and Efficacy of Nanobubble Technology Used in Water and Wastewater Treatment Processes
		Underway #1159 – Evaluate the Potential of Nanobubbles for Ferrous and Manganese Oxidation
	1 **Standardising Water Validation (WaterVal) - Collaborating across the water industry to coordinate treatment protocols to streamline the validation process.**	Underway #3050 – Assigning and Maintaining Appropriate Pathogen Log Removal Values in Membrane Bioreactors
		Underway: #3501 – WaterVal: Streamlining Technology Validation
		Underway: #3502 – Micro/Ultrafiltration Validation Protocol
		Underway: #3503 – WaterVal Validation Reference Guide
		Opportunity: #3504 – Activated Sludge Treatment Process Validation (RFF open)
		Underway: #3505 – Reverse Osmosis Chemical Validation Protocol
		Underway: #2074 and #3506 – Granular Media Filtration Validation Protocol Trial (RFF open)
		Underway: #3507 – WaterVal Protocol Template Review
	3 **On-site generation of treatment chemicals with low environmental impacts.**	Underway: #1136 – Sustainable Hydrogen Production from Used Water (ARC Linkage Project)
		Underway #3046 – UV/Chlorine AOP in Potable Reuse: Assessment of Applicability, Operational Issues, and Potential By-Products

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
ALGAL INNOVATION: PROACTIVE MANAGEMENT OF CYANOBACTERIA AND ALGAL BLOOMS Our goal is to build on decades of research to address emerging cyanobacteria issues and accelerate novel technology transfer for algal management.	1 **Understanding algal/cyanobacterial toxins and their metabolites as a secondary impact on water quality.**	Underway: #3049 – Cyanotoxin Risk in Recycled Water Used for Food Crop Irrigation and Livestock
		Underway: #2082 – Understanding and Optimising the Performance of Algae Co-Digestion with Waste Activated Sludge
		Completed: #1059 – Bad Tastes, Odours, and Toxins in Our Drinking Water Reservoirs: are Benthic Cyanobacteriathe Culprits?
	2 **Improving our ability to predict Blue-Green Algal events and understanding how this prediction will change with future climate variation.**	Completed: #1138 – Protocols for Algal Bloom Management - Technology Performance & Optimisation Assessments
		Completed: #1146 – Characterising the Drivers of Cyanobacteria Risks for Source Water in Australia
		Underway: #1161 – Rapid Knowledge-Guided Diagnostics for Harmful Algal Bloom Management
		Completed: #2058 – Understanding and Reducing the Spread of Antibiotic Resistance in Anaerobic Sludge Digestion
	3 **Exploring more cost-effective treatment technologies for algae and pathogens.**	Underway: #1153 – Scalable and Environmentally Sensitive Algae Management Tech: H_2O_2 Dosing
	3 **Wastewater treatment options for regional lagoon-based systems for water reuse and compliance outcomes.**	Research opportunity to explore

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
CONTAMINANTS OF EMERGING AND EMERGED CONCERN (CECs): BALANCED RISK ASSESSMENT AND MANAGEMENT APPROACHES The goal is to equip our members with innovative management and treatment approaches to effectively respond to contaminants of emerged and emerging concern.	1 **Emerging Contaminants Risk Prioritisation and Response**	Underway: #2081 – Researching Emerging Contaminants (RECON) Monitoring Program for the Eastern and Western Treatment Plants
		Opportunity: #1155 – Enhancing ECHIDNA: Further empowering water professionals to manage contaminants of emerging concern (RFF open)
		Underway: #1166 – Developing a Global Risk-based Tool for Prioritizing Contaminants of Emerging Concern (CEC) for the Water Industry (with Global Water Research Coalition - GWRC)
	1 **Quantifying PFAS in water industry products (water, recycled water, sludges, biosolids, biochar) and mass balance throughout the treatment train**	Underway: #1165 – Comprehensive PFAS Sampling in Drinking Water
		Opportunity: #2095 – Biosolids Thermal Treatment for PFAS Destruction: Tracking the Fate of Fluorine in Biosolids (RFF open)
		Underway: #3058 – Fate and Risk of PAPs and Short Chain PFAS in Biosolid Amended Agricultural Soils (ARC Project)
		Underway: #3052 – crcCARE - Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
		Underway: #2067 – ARC ITTC Training Centre for the Transformation of Australia's Biosolids Resource
	2 **Quantifying microplastics and their effect on the wastewater treatment process**	Completed: #2063 – Microplastics in Wastewater Effluent
		Completed: #2072 – Microplastics in the Environment
		Underway: #1158 – Understanding the Effect of Microplastics on the Performance of Anaerobic Sludge Digestion
	2 **Further exploration of effects-based monitoring and/or Non-Target Analysis: Methods to contribute to safety of water supplies.**	Completed: #2057 – Effects-based Monitoring in Water Safety Planning
		Completed: #2051 – Saving Nemo: Reducing Animal Use in Toxicity Assessments of Wastewater

Research Program Focus Area	Key Priority	Activities
ONE HEALTH - SAFE WATER FOR PEOPLE, ANIMALS AND OUR ENVIRONMENT Our goal is to enhance our members ability to collaborate both within and outside the water services sector to promote an integrated and unified approach to tackling common issues.	1 **Develop strategic solutions for the water Industry to help prevent Antimicrobial Resistance (AMR).**	Underway: #3051 – SAAFE (CRC for Solving Antimicrobial Resistance in Agribusiness, Food, and Environments); Monitoring, Risk Assessment and Digital Transformation.
		Underway: #2079 – Understanding and Reducing the Spread of Antibiotic Resistance During Disinfection
	1 **Wastewater Based Epidemiology for One Health**	Completed: #2085 Knowledge Synthesis of the Victorian Sewage Surveillance Program for SARS COV-2
		Underway: #2086 – Exploring Social License for Wastewater Surveillance
		Underway: #2093 – Wastewater Based Epidemiology Community of Practice
		Underway: #3047 – Sewaus Census 2021 – Understanding Chemical and Biological Hazards Through Analysis of Wastewater and Biosolids
		Underway: #1150 – The Inclusion of Faecal Source Tracking (FST) Into Monitoring Programmes to Inform Microbial Risk Assessments

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
DISINFECTION: EFFECTIVE TREATMENT OUTCOMES Our goal is to provide our members with improved foresight on innovative disinfection approaches with a focus on risks and opportunities.	1 **Disinfection By-Products assessment and management.**	Underway: #1162 – Effects-based Monitoring for DBPs in Drinking Water; Impact of water treatment processes on Disinfection By-Product formation and toxicity (ARC project)
	2 **Treatment methods for DBP reduction that do not produce significant waste streams in the water treatment process and/or the reticulation network.**	Underway: #1144 – Minimising Brominated Disinfection By-Products
	3 **Impact of distribution system on aesthetic water quality for customers.**	Research opportunity to explore
	3 **Understanding pathogen risks in water storage and distrubution systems**	Completed: #1156 – Pathogen Risk in Treated Water Assets or Storage Tanks

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
ALTERNATIVE WATER SOURCES – FIT-FOR-PURPOSE SOLUTIONS ACROSS THE WATER PORTFOLIO Our goal is to provide adequate scientific underpinnings to enable our members to deliver safe water, balanced across technological solutions and a broader source and product portfolio.	1 **Enhanced source water monitoring and control for Purified Recycled Water.**	Underway: #3056 – Enhanced Source Water Monitoring and Control for Purified Recycled Water
		Opportunity: #2070 – ClearPathogen: Real Time Validation of Barrier Integrity in Water Treatment
		Underway #3053 – Augmenting Water Bodies with Highly Treated Recycled Water (HTRW)
	1 **Addressing technical barriers and challenges for stormwater reuse schemes.**	Completed: #3045 – Proof of Concept: Application of UV LEDs for Control of Opportunistic Pathogens in Building System Water Utilising Non-traditional Sources
		Completed: #3048 – Update Stormwater Quality Knowledge for Australian Guidelines for Water Recycling (AGWR)
		Opportunity: #3060 – White Paper: Overcoming Barriers to Stormwater Reuse as an Alternative Water Source (RFF open)
	2 **Business models for the decentralisation of alternative water systems (including stormwater treatment) versus large scale capital augmentation.**	Research opportunity to explore
	3 **Management of waste streams from alternate water sources i.e. Investigating options for brine treatment and disposal, including the beneficial uses of brine.**	Research opportunity to explore

Service Delivery Research Program

Ensuring affordable, fit-for-purpose water services for all

The water industry has a shared mandate to ensure safe and reliable water services that meet affordability criteria and are fit for purpose. WaterRA and its BIG Team have the opportunity to provide value by aligning with One Health goals as set down by the World Health Organisation to provide an integrated, unifying approach to sustainably balance and optimise the health of people, animals and ecosystems.

There are many potential cross-cutting research initiatives that may apply to service delivery and help to optimise the value chain for water resource management, distribution, treatment, and recovery. Looking to the future, industry members identified opportunities to address significant risks in relation to extreme and other disruptive events. In particular, it was recognised that emerging technological and digital advancements have great potential to increase the capabilities of predictive tools and enhance the capacity to respond to operational challenges and water quality incidents with greater agility.

Drivers for research in this area include:

- The need for greater predictive and timely assessment capabilities to respond to and maintain safe water supplies in the face of extreme or disruptive events.
- Advances in monitoring technology and the potential for coupling with Artificial Intelligence platforms.
- The attractiveness of Internet of Things technology to improve utilities' operational efficiencies around monitoring and control of networks and treatment technologies.

Research Program Focus Areas

Extreme and Disruptive Events - Prevention, Preparedness, Response and Recovery

Data and Smart Technologies for a Resilient Future

Research Program Focus Area	Key Priority	Activities
EXTREME AND DISRUPTIVE EVENTS – PREVENTION, PREPAREDNESS, RESPONSE AND RECOVERY Our goal is to enhance our members' ability to maintain their business continuity in the face of disruptive and extreme events, to maintain safe and reliable supplies.	1 **Developing risk assessment guidance to increase resilience of catchments and recycled water sources to the impacts of extreme events.**	Underway: #1100 – Better Data-Driven Decision Making Under Future Climate Uncertainty (Resiliwiki)
		Underway: #1145 – Bushfire Recovery for Resilience: Bushfire Modelling as an Enabling Decision Support Tool
		Underway: #1152 – Improving Water Quality Analysis in Response to Extreme Events: Fires and Floods (Stage 2)
		Completed: #1063 – Identify and Assess the Water Quality Risks from Extreme Events
	3 **Minimising sewer network overflows**	Underway #2092 – Next-Generation Grease Interceptors for Minimisation of Sewer Blockages

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
DATA AND SMART TECHNOLOGIES FOR A RESILIENT FUTURE Our goal is to assist our members in utilising emerging technologies to support efficiencies in monitoring and managing operations and the performance of water assets.	1 **Developing water-industry tailored decision support tools and standards that ensure sound IoT/OT/IT operating models and data governance, and support the identification of prudent, long term digital investments.**	Change to Underway: #2099 – ARC Internet of Things (IoT) Water Hub: A Collaboration in Real-time Monitoring and Control
	1 **Exploring the potential of fit-for-purpose advanced analytics and the use of AI and Big Data to drive operational efficiencies and early detection and warning systems.**	Completed: #1134 – State of Knowledge and Capability for Remote Sensing for Water Utilities
		Underway: #2084 – ARC Sewer Monitoring and Management in the Digital Era (ARC Project)
	2 **Exploring and assessing advances in monitoring technologies for water quality monitoring and management.**	Underway: #1147 – Satellite Remote Sensing WaterNSW Quality Model
		Underway: #1163 - Aquawatch Australia Collaboration
	3 **Collaborate with researchers and technology developers to optimise energy efficiency in water processes, pumping stations, and water heating. Explore the use of Artificial Intelligence and machine learning tools for predictive maintenance and process optimisation.**	Research opportunity to explore

Circular Economy Research Program

Closing the loop on resource generation and use

The linear delivery model currently utilised in our economy, which consists of take-make-use-dispose, is no longer tenable given its impact on our already stressed environment. As a result, finite resources such as freshwater, nutrients and fossil fuels are depleting, affecting the environment, the economy and communities. There is, therefore, an urgent need to close the loop on resource generation and use; we need to transition to a circular economy.

The Ellen MacArthur Foundation bases the circular economy on three principles:

1. Elimination of waste and pollution
2. Circulation of products and materials
3. Regeneration of nature

WaterRA has worked with our BIG team to prepare a rigorous Circular Economy Framework that can be viewed **here**.

Drivers for research in this area include:

- A need to comply with regulatory requirements, respond to community expectations and improve resilience.
- To capture the numerous opportunities a circular economy brings to the water sector such as a net-positive environmental and social impact and revenue diversity.

Research Program Focus Areas

The Path to Net-Zero Emissions

Hydrogen Economy in the Water Industry

Realising the Full Value of our Resources

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
THE PATH TO NET-ZERO EMISSIONS Our goal is to propel the Australian water industry towards net-zero emissions.	1 **Advance greenhouse gas emissions quantification, reduction and offset technologies and methodologies.**	Complete: #2059 – Quantifying Scope 1 Emissions From Sewerage Treatment Plants Underway: #2087 – Reducing Direct Greenhouse Gas Emissions from Urban Wastewater System (ARC Linkage Project) Underway: #2091 – Feasible Quantification of Greenhouse Gas Emitted from Wastewater Treatment (ARC Industry Fellowship) Underway: #1164 – Mitigation of Methane Emissions from Water Supply Storages Underway: #2098 – A Practical Guideline to Monitor and Quantify Nitrous Oxide Emissions from Full-scale Wastewater Treatment Plants (with Global Water Research Coalition - GWRC)
HYDROGEN ECONOMY IN THE WATER INDUSTRY Our goal is to provide direction and a strong voice to the water industry in the hydrogen space.	2 **Optimise water sources and quality.** **Create an enabling regulatory environment.** **Close the loop to ensure green systems.** **Establish and maintain social licence.**	Underway: #1136 – Sustainable Hydrogen Production from Used Water (ARC Linkage Project) Underway: #3061 – Green Oxygen for Wastewater Treatment (ARENA Project)
REALISING THE FULL VALUE OF OUR RESOURCES Our goal is to identify untapped resources (e.g., carbon, nutrients, brine), explore opportunities for beneficial recovery and overcome barriers to resource valorisation.	1 **Improve technologies.** **Improve products.** **Ensure safe circularity.**	Underway: #2067 – ARC Training Centre for the Transformation of Australia's Biosolids Resource Complete: #2073 – Upcycling of Biosolids into Biochar as a Win-Win-Win for Environment, Economy and Community Underway: #2088 – Ammonium Selective Membrane to Transition the Water Industry into Circular Economy (RFF open) Opportunity: #2095 – Biosolids thermal treatment for PFAS destruction: tracking the fate of fluorine in biosolids

Liveability Research Program

Expanding the water supplier's role in public and environmental health

The water industry is pivotal to the experience and productivity of our cities, towns and neighbourhoods, because of the role it plays by providing quality water, wastewater and drainage services. These services also enhance our cities' and regions' liveable spaces, and contribute to their long term sustainability and productivity. In essence, our communities understand that water services are critical to our economic wellbeing and quality of life.

The advancement of liveability by the water industry is seen as a progression give the extent of basic services already delivered. The benefits offered by the water industry extend to the enhancement of natural systems, disaster risk management and protection and improvement of public health. However, there remain challenges for furthering the mandate of using water utility services to improve the liveability of our spaces. Hence the need for ongoing research to unlock pathways for improving the liveability outcomes.

Drivers for research in this area include:

- Providing water and land for green infrastructure including green parks, open spaces and corridors to support active, healthy lifestyles.
- Supporting blue infrastructure including clean healthy beaches and waterways with community and ecosystem benefits.
- Supporting cool, healthy environments by using water and greening to reduce heat in the urban landscape and improving air quality.

Research Program Focus Areas

Managing Catchment Risks from Recreational Access

Supporting the Liveable Communities Value Proposition

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
MANAGING CATCHMENT RISKS FROM RECREATIONAL ACCESS Our goal is to help our members apply the best available research to protecting water catchments while ensuring social and environmental outcomes.	1 **Understanding the implications of making reservoirs accessible to the public, on drinking water treatment.**	Complete: #1124 – Understanding Impacts of Recreational Access to Drinking Water Catchments and Storages in Australia
SUPPORTING THE LIVEABLE COMMUNITIES VALUE PROPOSITION Our goal is to support our members' liveability strategies with well researched tools and approaches.	2 **Development of a nationally accepted method for valuing (both quantify and monetisation) the liveability co-benefits associated with urban catchment management.**	Research opportunity to explore Underway: #1140 – Catchment Health Metrics
	3 **Enable a better understanding or the science and opportunities for nutrient offsets (as a co-benefit) and how to build regulator acceptance.**	Research opportunity to explore
	3 **How to implement cool parks and their role in future water requirements vs their measurable benefits**	Research opportunity to explore

WaterRA recognises the critical role of the water industry in shaping liveable, sustainable, and resilient communities. We are actively seeking opportunities to expand our Liveability Research Program, collaborating with our members to explore new research pathways that drive meaningful improvements in urban and regional liveability. If your organisation is interested in contributing to or co-investing in research that advances these outcomes, we invite you to connect with us and be part of this important conversation.

Workforce Research Program

Building an industry of choice

The water industry has collectively recognised that it takes a multipronged approach to create and retain a vibrant workforce. A focused research effort is needed to better understand how worker development, diversity, and safety impact the workplace. To gain increased knowledge about the intricacies of how operational staff remain skilled in the new and emerging tasks of a future-focused, digital utility, whilst also retaining the deep knowledge of practical experiences, remains both a formidable challenge and opportunity.

Drivers for research in this area include:

- Emerging skill gaps in the drive for digital and highly knowledgeable water supply operational experts.
- Loss of institutional knowledge in a transitional workforce.
- Regulatory pressure to ensure that incidents affecting work health and safety or water quality due to operator error are avoided.
- The need for an agile, highly trained and diverse workforce to embrace innovation thinking.
- The opportunity to retain staff in a highly competitive market by providing growth and development opportunities and positive experiences.

Research Program Focus Areas

Enabling the Future Workforce to Succeed

PRIORITY LEVEL 1 HIGH 2 MEDIUM 3 LOW

Research Program Focus Area	Key Priority	Activities
ENABLING THE FUTURE WORKFORCE TO SUCCEED Our goal is to support the water industry with 'personnel and technology – focused' research that assist in creating a vibrant and safe workforce.	1 **Assessing the value of research to ensure evidence-based decision making and realisation of research benefits to enable a positive organisational research culture.**	Underway: #1160 – Value of Research Phase 3: Driving the Value of Research Principles from a Useful and Useable Set of Products to a 'Used' Tool
		Underway: #1130 – The Role of Knowledge Brokers in Achieving Research Impact in the Water Industry
	1 **Creating standardised approaches to training a diverse and often transitional workforce.**	Complete: #1139 – Water Operations Technical Competency Benchmark & Lessons Learned from Experienced Operators
		Underway: #1167 – Water Industry Operator Critical Decision - Making in Incident and Emergency Response
		Underway: #3501 – WaterVal: Streamlining Technology Validation (training component)