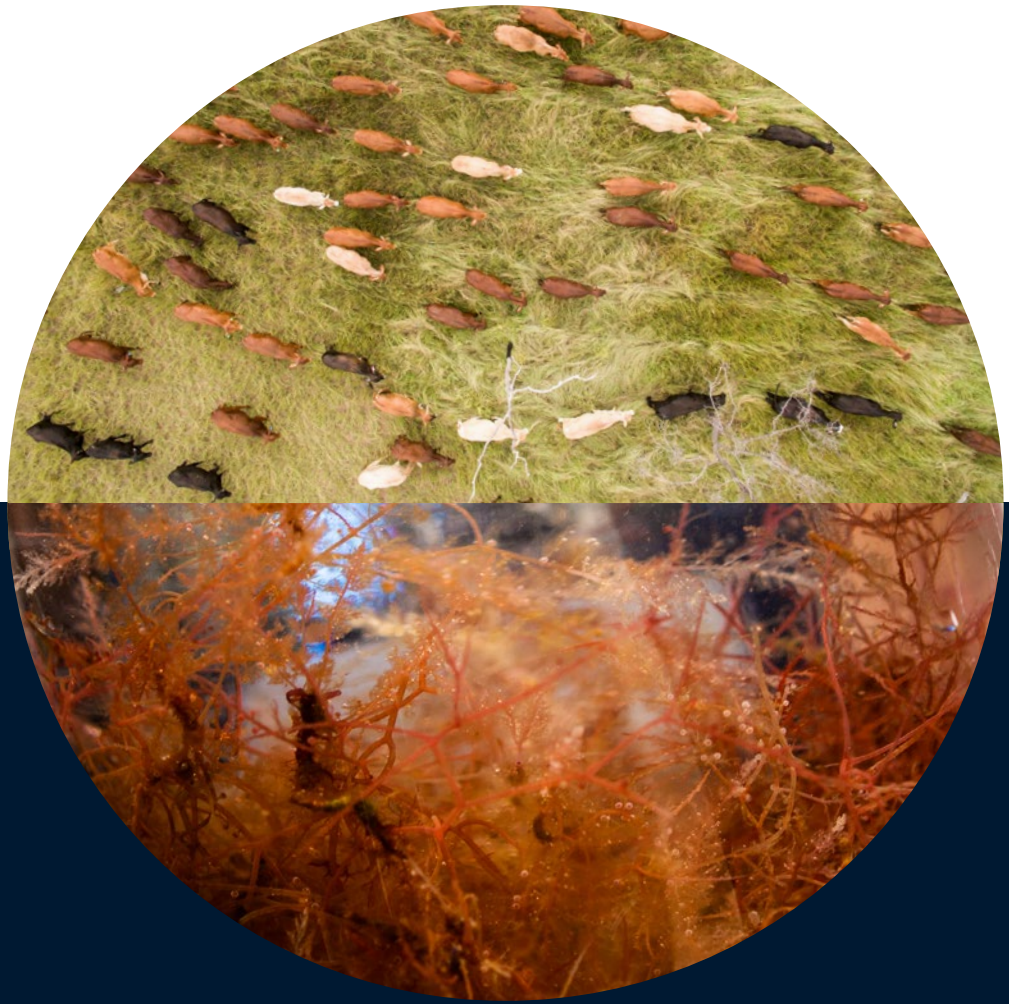
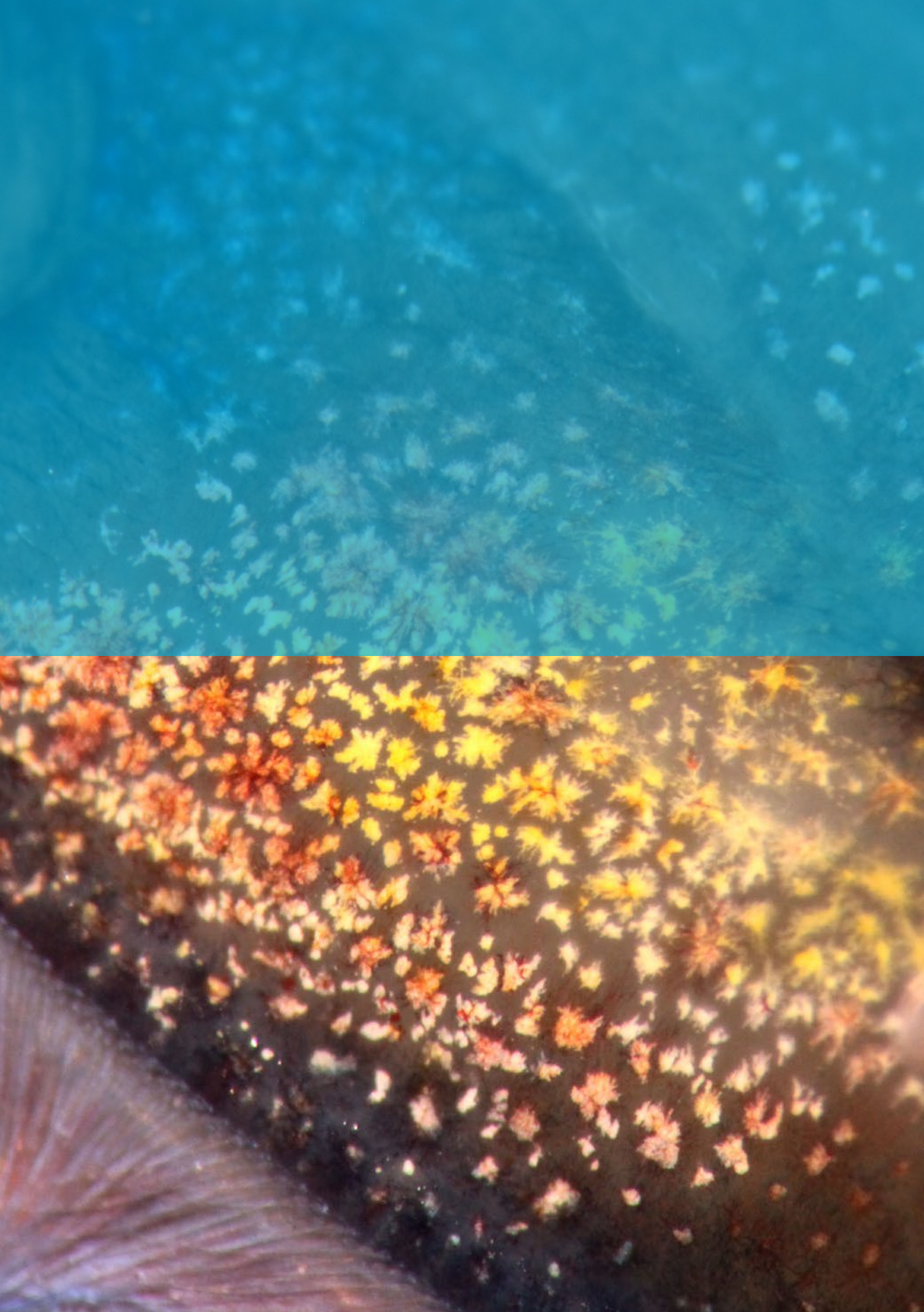
CSIRO

Australia's National
Science Agency



Annual Report 2020–21



Our annual report

This annual report provides a summary of our activities and performance for the financial year ended 30 June 2021 against the planned objectives and outcomes in our Corporate Plan and Portfolio Budget Statements.

Read the annual report online: csiro.au/annualreport2021

CSIRO

We are Australia's national science agency and innovation catalyst. As one of the largest and most multidisciplinary mission-driven research organisations in the world, we unlock a better future for everyone.

Our purpose

Solving the greatest challenges through innovative science and technology.

Our vision

We are Australia's innovation catalyst, collaborating to boost Australia's innovation performance.

Cover: Methane emissions from cattle (top picture) can be reduced by more than 80 per cent when they're fed an additive based on the seaweed Asparagopsis (bottom picture). Using IP from CSIRO, Meat & Livestock Australia and James Cook University, we created the company FutureFeed to commercialise this solution from science. Read more about FutureFeed on page 48.

Credit: Andrew McInnes austockphoto.com.au (top), CH4 Global (bottom).

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30 August 2021

The Hon Angus Taylor MP
Acting Minister for Industry, Science and Technology
Parliament House
CANBERRA ACT 2600

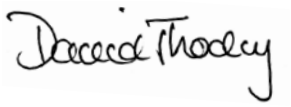
We have pleasure in submitting to you, for presentation to Parliament, the 73rd Annual Report of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the year ending 30 June 2021. This report has been prepared in accordance with the requirements of the *Science and Industry Research Act 1949*, section 46 of the *Public Governance, Performance and Accountability Act 2013* and the *Public Governance, Performance and Accountability Rule 2014*.

The report was endorsed at the meeting of the CSIRO Board members on 30 August 2021.

Part 6 is a report on the operations of the Science and Industry Endowment Fund (the Fund), which was established under the *Science and Industry Endowment Act 1926*. It also includes a report by the Auditor-General on the accounts of the Fund.

The Corporate Commonwealth Annual Reporting Rule requires CSIRO to report any significant activities and changes that affected the organisation or structure. During the reporting period, we continued to respond to the ongoing pandemic and supported Australia's response to COVID-19. We contributed to our nation's ability to work towards a sustainable future through our work on energy transitions and a stronger circular economy. We worked with your department and provided advice on the modern manufacturing policy implementation. Our efforts on advising communities on resilience and recovery were also significant.

We are proud of CSIRO's achievements this year.



Mr David Thodey AO
Chairman of the CSIRO Board

Dr Larry Marshall
Chief Executive of the CSIRO

CSIRO
Australia's National Science Agency

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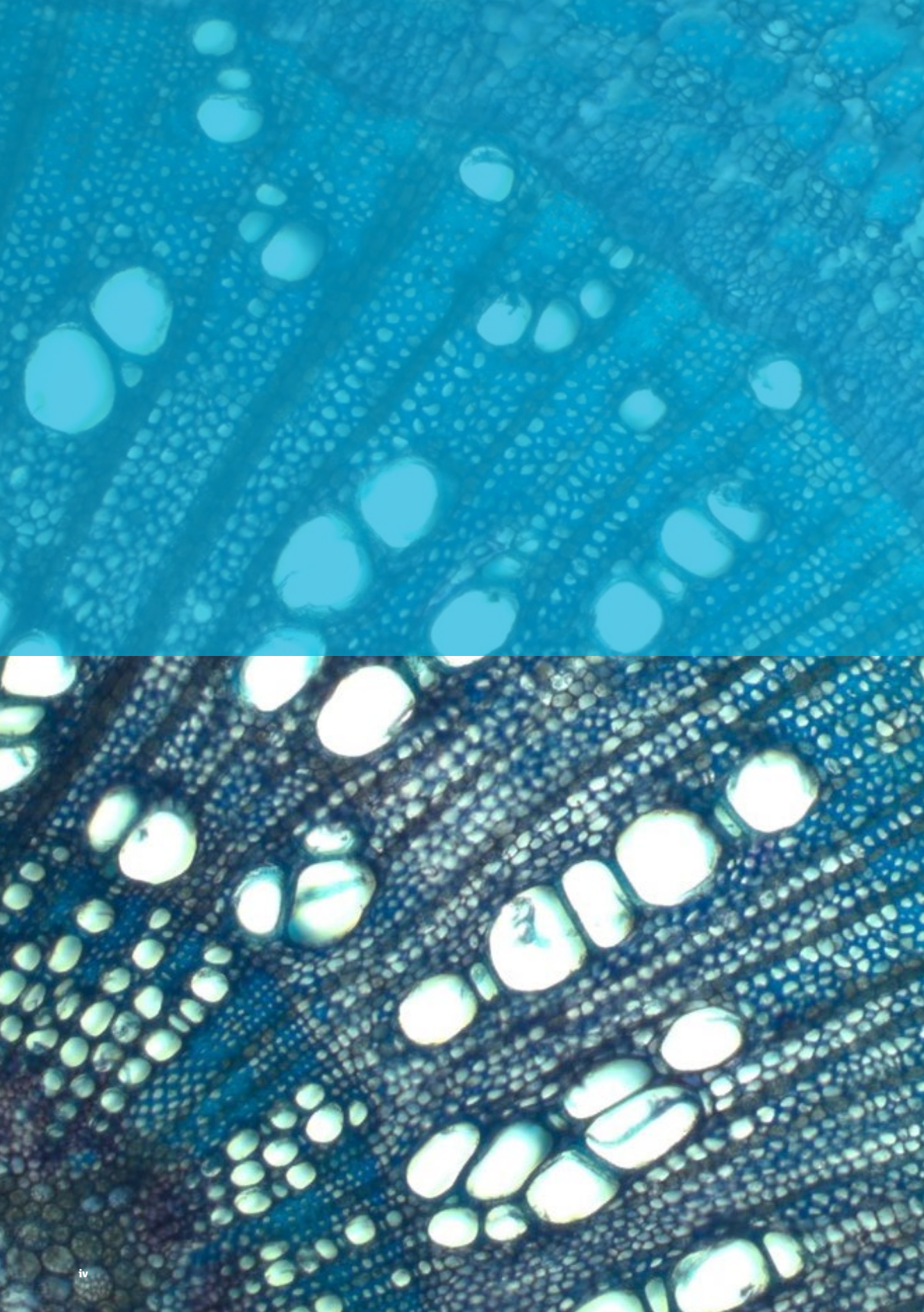


Part 1

Our purpose and strategy

Foreword by the Chairman

This year, we've faced unprecedented challenges, and the national science agency delivered on its most important mission yet – one of recovery and resilience. As I reflect on one of the most trying periods in our nation's history, CSIRO's purpose, to solve the greatest challenges with science and technology, has never been in sharper focus.

Australia's approach to COVID-19 set us on the path to where we are now – we gave science a voice. Using that voice, in collaboration with our partners, what we achieved together over the last 12 months is astounding.

Our science directly contributed to the acceleration of the global fight against COVID-19, and the achievement of something incredible: in less than a year, science delivered the development and manufacture of the first human vaccines against a coronavirus.

Our people, of all backgrounds, working together have done an incredible job during this time, and I greatly appreciate their commitment, passion, and the contribution they have made to each and every Australian.

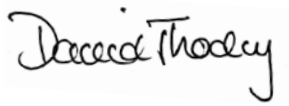
As vaccines started rolling-out across the country, our people were working on how we rebuild our economy with new and transformed industries, how we mitigate and adapt to threats like drought, fire, flood, and climate change, and how we build resilience to future shocks from infectious disease.

Our people are collaborating widely with Australian universities, government, industry, and business on a program of missions to secure Australia's future wealth, sustainability, and prosperity.

We are investing in the future science and technology that will give Australian businesses a competitive advantage as we move into a post-COVID era that will be more digitised. A focus on lowering emissions and improving our preparedness for future shocks will also increase our sustainability and resilience.

We have achieved some incredible things over the last year, but we did not do it alone. I want to thank our partners who have worked as tirelessly as we have, our government for elevating the voice of science to lead Australia through crisis, and 25 million Australians for supporting the scientists who support you.

Lastly, and with great emphasis, I want to thank our people. You are at the heart of everything we do, and I feel so privileged to have the honour of working with you. I hope you feel as proud as I do of the contribution that together we have made to our country.



Mr David Thodey AO
Chairman of the CSIRO Board

Chief Executive's report

Over the last 12 months, Australia turned to science to solve the most pressing challenges. We have answered that call, using science to emerge from drought, bushfires, COVID-19, and to stave off a recession. CSIRO is helping lead Australia to a bold, science and technology-led recovery.

This annual report illustrates CSIRO delivering for all Australians, using research translation to solve some of the greatest challenges faced by our country. Careful planning, investment and foresight to keep CSIRO at the edge of scientific discovery, provides Australian industry a competitive advantage, and it sets us up to be the Agency of the Future we envisage by 2030.

CSIRO scientists' work helped Australia recover from the Black Summer fires and set the course for better preparation to manage bushfire seasons that are getting hotter, drier, and longer. Our Report on Climate and Disaster Resilience showed how research, science and technology can help us adapt to a changing climate. Our advice to state and federal enquiries draws on 70 plus years of bushfire research. We used satellite data to monitor spread and conditions and released new technology including artificial intelligence (AI) to outthink and stay one step ahead of fires.

We continue building on our critical COVID-19 work. Our Australian Centre for Disease Preparedness continues its pivotal role in understanding vaccines, therapeutics and the virus. Our animal models and pre-clinical testing accelerated the Oxford University-AstraZeneca vaccine, which is now manufactured in Australia.

Our science also helped Australia adapt to life with COVID-19, applying research to deliver solutions to keep Australians safe. We established Australia's first testing and verification capability for surgical face masks, and used wastewater testing to pinpoint hotspots along with predictive analytics to better manage our responses to outbreaks. These solutions are assisting us to build resilience to future shocks from infectious disease and rebuild our economy to be stronger than before.

We committed to invest more than $100 million over 4 years to deliver collaborative missions that will drive recovery and resilience. We are forming coalitions across industry and research to mobilise new wealth generation opportunities for Australia.

In May, we launched our first mission aimed at catalysing a new clean hydrogen export industry worth $11 billion per year in Gross Domestic Product and 8,000 jobs. The mission attracted $68 million of co-investment from partners, and together will roll out more than 100 projects to drive down hydrogen production costs and position Australia to lead the world in hydrogen exports by 2030.

Main Sequence, the deep technology fund founded by CSIRO, raised a second CSIRO Innovation Fund of $265 million to invest in deep-tech start-ups and create new companies from science. We brought in industry to co-invest with us and create companies like Endua from venture science – a new model for commercialisation.

Overall, this year, we faced a very challenging time. COVID-19 brought multiple lockdowns, and our people worked from home while juggling caring responsibilities, isolation, and concern for loved ones. We made flexible and remote working the norm, provided support services to bolster mental health, and reinforced safety, health and wellbeing as important for all.

I am proud of the way everyone is part of who we are and what we do at CSIRO and our commitment to diversity and inclusion. Again, we achieved Gold Employer status at the Australian LGBTQ (lesbian, gay, bisexual, transgender, queer) Inclusion Awards, and we made progress on our Science in Australia Gender Equity Action Plan.

We created a new Indigenous Science Program and welcomed our first Indigenous Science Program Director to help integrate Indigenous science and western science. Our new Sustainability Strategy 2020–30 provides a framework to improve our environmental, economic and social impact performance, and it enables us to be an exemplar of sustainable culture, practice and operations.

Looking ahead, we laid out our vision for our Agency of the Future, including who we want to be and how we want to work, and the technology and infrastructure that will enable that. We continued our journey of digital transformation, upskilling our people and designing Labs of the Future.

I am proud of what our people have delivered for Australia in these challenging times. We were there when Australia needed us, and we are here helping our nation to prepare for future challenges. We will continue to deliver solutions from science and steer Australia to a more prosperous and resilient future.

Dr Larry Marshall
Chief Executive, CSIRO

About us

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

We are Australia's most trusted research institution and most connected innovator, working with Australian universities, government departments and major Australian industries.

We are one of the largest and most multidisciplinary mission-driven research agencies in the world. Our more than 5,200 people are based across 58 sites in Australia and around the world, and we manage state-of-the-art research facilities for the nation.

Our collaborative research turns science into solutions for food security and quality; clean energy and resources; health and wellbeing; resilient and valuable environments; innovative industries; and a secure Australia and region.

We deliver around $7.6 billion of benefit to the nation each year as a result of our science, securing our future national prosperity as well as environmental and social benefits.

CSIRO. Unlocking a better future for everyone.

5,221 people
delivering impact across 58 sites

Main Sequence raised a second CSIRO Innovation Fund of
$265 million

160,000 students
took part in STEM education programs

We reduced our carbon emissions by
more than 60%

We introduced 2 new Future Science Platforms:
Quantum Technologies and Microbiomes

We worked with 492 international customers across 70 countries

We engaged with over 3,900 industry and government entities and attracted 944 new customers

We launched our first mission, which attracted $68 million from partners:
Hydrogen Industry Mission

Our purpose

We are an Australian Government statutory authority within the Industry, Science, Energy and Resources portfolio, operating under the provisions of the *Science and Industry Research Act 1949* (SIR Act). To align with our Portfolio Budget Statement outcome statement, we describe our purpose as:

Solving the greatest challenges through innovative science and technology.

Our vision

Recognising our unique role in Australia and the highly collaborative and innovative nature of what is needed to solve the greatest challenges, our vision is:

Australia's innovation catalyst, collaborating to boost Australia's innovation performance.

Our outcome

Consistent with our legislation, our intended outcome as stated in the Portfolio Budget Statements is to produce innovative scientific and technology solutions to national challenges and opportunities to benefit industry, the environment and the community, through scientific research and capability development, services and advice.

Our strategy

Our strategy, as captured in our Corporate Plan, directs how we will achieve our purpose. It comprises our objectives, activities and outcomes, supported by strategic pillars that guide our science.

Our objectives

For over 100 years, we have been the mission-led national science agency, collaborating across the innovation system. These primary objectives, guided by the SIR Act, help us to deliver on our purpose:

1. Conduct and encourage the uptake of world-class scientific research.
2. Mobilise and develop the best talent for the benefit of Australia.
3. Manage national research infrastructure for the benefit of the nation.
4. Ensure the sustainability of CSIRO.

Solving the greatest challenges

We identified 6 challenges as the areas of greatest importance to Australians. We solve these challenges through our portfolio of missions. Together, the challenges and missions drive Australia's recovery and resilience following recent national crises.

1 Health and wellbeing

Enhancing health for all through preventive, personalised, biomedical and digital health services.

- Hospital managers are using information we gathered on aerosol generation to develop evidence-based guidelines to minimise staff exposure to aerosols produced during medical procedures. Read more about our aerosols work on page 25.
- Our software tool, Ontoserver, helped healthcare systems recognise clinical terms, which resulted in better reporting for healthcare workers and better results for patients. Read more about Ontoserver on page 71.

2 Food security and quality

Achieving sustainable regional food security and growing Australia's share of premium agri-food markets.

- We participated in the Australian Agriculture COVID-19 Supply Chain Resilience project, which looked at how disruptions such as droughts, floods and storms affect national food production and food security. Our work identified 2 new areas of research for developing a healthier, more resilient and sustainable domestic food system. Read about how we're sustaining Australian food systems on page 29.
- Our researchers developed a novel solution to provide protection against Ug99, a recent stem rust variant, and other known variants of commercial significance. They clustered 5 individual genes that each provide resistance against stem rust into a single gene stack, making for easy introduction into a wheat variety's genome. Read more about our wheat work on page 78.

3 A secure Australia and region

Safeguarding Australia from risks such as war, terrorism, pandemics, disasters and cyber-attacks.

- The survival rates of infectious SARS-CoV-2 on 6 common surfaces were studied. The virus was found to survive for around 2 weeks, with quantities detectable for up to 28 days on glass and plastic banknotes. Read more about the survival rate of SARS-CoV-2 on page 27.
- We developed common technical standards in data formats and security profiles as part of our work on the Consumer Data Right legislation, which was launched as 'Open Banking'. Using secure and easy-to-use processes, it revolutionised the way consumers share their banking data. Read about Consumer Data Standards on page 64.

4 Resilient and valuable environments

Enhancing the resilience, sustainable use and value of our environments.

- Satellite hotspot data was used to map the scale of the 2019–20 bushfires as well as herbarium records to determine the plant species most affected. This allowed us to provide timely ecological data to assist in planning for, and responding to, extreme climatic and other future catastrophic events. Read about satellite hotspot data on page 111.
- Using our 1622WQ™ app, farmers now have real-time information on key factors for growing sugarcane. 1622WQ™ brings together information on sugarcane production and environmental performance to help farmers evaluate their crop management, facilitate better decisions and protect the GBR. Read more about 1622WQ™ on page 47.

5 Sustainable energy and resources

Building regional energy and resource security and our competitiveness while lowering emissions.

- Our Hydrogen Industry Mission was launched to enable a globally competitive Australian hydrogen industry by 2030 through research, development and partnerships that activate the market and lower the cost of clean hydrogen to under $2 per kilogram. Read about the Hydrogen mission on page 21.
- We tested and validated methods using carbon capture and storage technologies that could be adopted to monitor coastal environments where carbon dioxide geological storage sites may be located. This work advanced Australia's capability to mitigate atmospheric carbon dioxide and is helping the nation respond to the challenge of emissions reduction. Read more about carbon capture and storage on page 52.

6 Future industries

Creating Australia's future industries and jobs by collaborating to boost innovation performance and STEM skills.

- We provided the Australian Government with the *National Circular Economy Roadmap* for plastics, tyres, glass and paper to help the nation realise its largest economic gains. Read about this roadmap on page 23.
- Australia's first accredited single-use surgical face mask testing facility was opened, which enables manufacturers to test their products to Australian and international standards in Australia. This was invaluable during the pandemic when international supply chains were disrupted. Read about this facility on page 31.

Missions

Our Missions program is a big, bold and inspirational endeavour that aims to mobilise science, technology and innovation to bolster Australia's COVID-19 recovery, build resilience and provide practical responses to these national challenges. Due to their scale, ambition and collaborative nature, missions are being co-developed with partners in Australia and overseas. Read more about our missions on page 20.

Strategic pillars

Our pillars, defined in our Corporate Plan 2020–21, guide our operations and how we bring our purpose, vision and strategy to life.

Customer focus

Focusing on our customers' needs today and in the future by actively prioritising our resources and relationships on the highest impact opportunities.

Thriving people and teams

Putting our people and their safety first, while supporting them to thrive and adapt in a changing world.

Collaborative networks

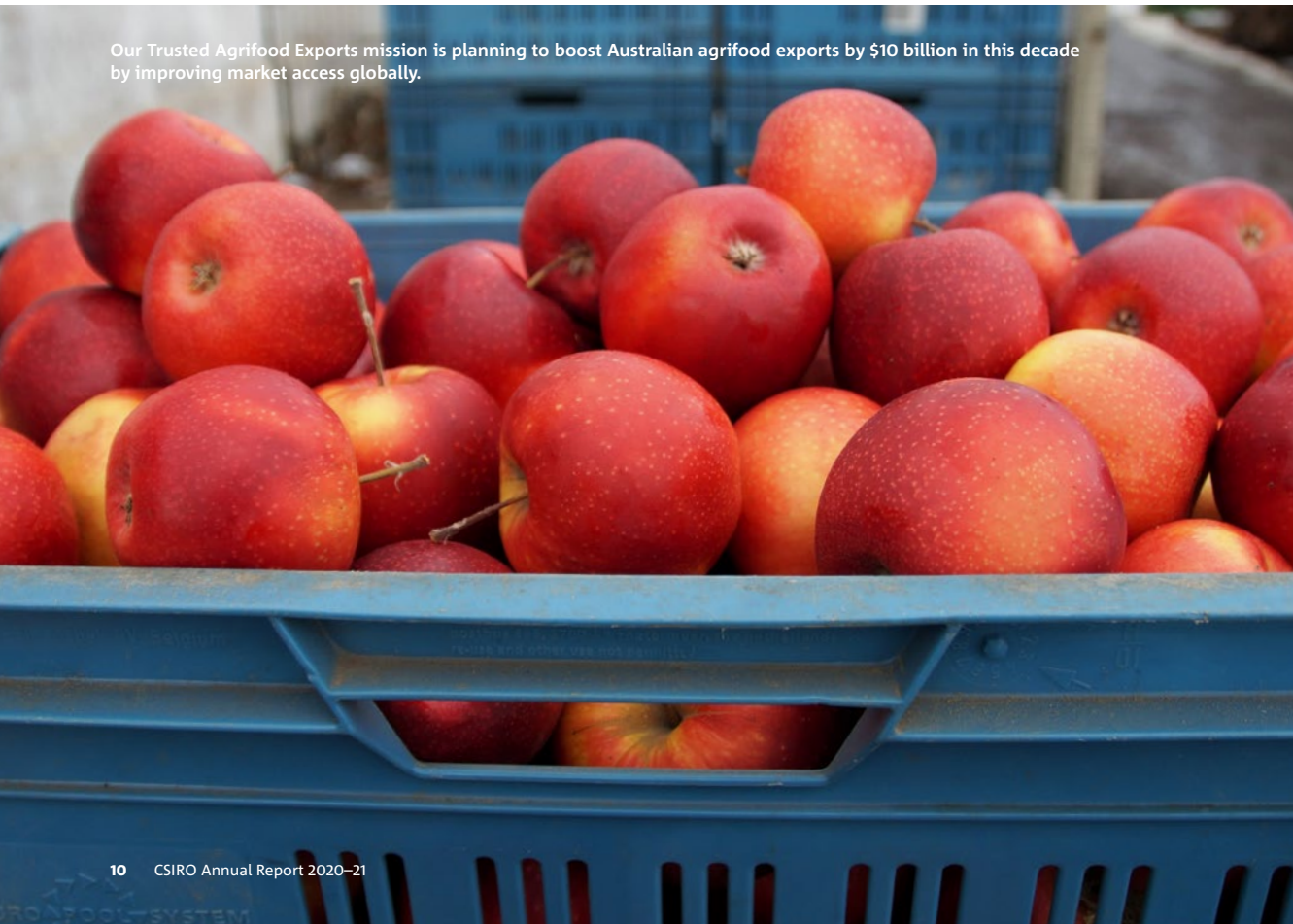
Leveraging our unique role as a connector with customers and partners to drive the uptake and adoption of solutions and improve Australia's innovation performance.

Solutions from science

Through excellent science, engineering, technology and innovation, provide trusted, effective solutions for industry, government and the community.

National benefit from global engagement

Connecting the world's best partners and capability to catalyse the uptake of our science and solutions and strengthen Australia's security and competitiveness.



Our Trusted Agrifood Exports mission is planning to boost Australian agrifood exports by $10 billion in this decade by improving market access globally.

The CSIRO BioFoundry is a state-of-the-art facility that lets scientists rapidly design, build and test new biotechnologies at a scale that wasn't possible before.

Values

Our values guide our cultural vision by clarifying what we consider important, guiding behaviours and decision-making for all our people. Our values articulate the manner in which we work every day as we deliver on our strategy.

People first

Caring for everyone's safety and wellbeing. Seeking out, listening to and learning from our differences. We do this by being respectful, caring and inclusive.

We do more to keep our people safe by making sure safety and wellbeing are the first things we consider in every decision we make, not just another box we tick or something we compromise for the sake of other priorities. Safety isn't management's job; its everyone's job.

Further together

Achieving more together than we ever can alone. Celebrating our success and our failures, leveraging them to achieve even greater things. We do this by partnering, cooperating and being humble.

We reach more deeply into our own organisation to take a truly one-CSIRO approach to our work. When we're doing something new, we ask someone to check to ensure we haven't missed something: this is how we keep each other safe.

Making it real

Embracing ambiguity, taking educated risks, stimulating discussion and delivering science for impact. We do this by being curious, adaptive and entrepreneurial.

We push our work further to make life better for more people by thinking about who benefits from what we do each day.

Trusted

Providing dependable, evidence-based answers driven by purpose. Earning trust through everything we do. We do this by being accountable, authentic and courageous.

We question each other if we think something isn't right and hold ourselves and our teams to the highest standards Australia expects of us. Especially in safety, if it doesn't feel right, we don't do it.

Celebrating our people

Underpinning our impact are our extraordinary people who bring their capability and teamwork to deliver solutions from science. They're committed to fulfilling our organisation's purpose and delivering the greatest national benefit. Many of our people receive awards from a variety of institutions and we are incredibly proud of their achievements. This is a selection of their recognitions during 2020–21.

Officer of the Order of Australia (AO)

Dr Evans Lagudah, Chief Research Scientist, Crop Resistance Genes, for distinguished service to agriculture and food science as a researcher in wheat genetics.

Dr Stephen Rintoul, CSIRO Fellow, for distinguished service to climate science through oceanographic and Antarctic research and policy development.

Australian Academy of Technology, Science and Engineering (ATSE) Fellowship

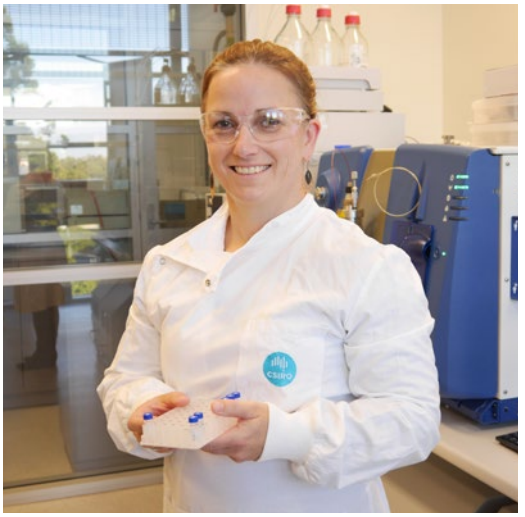
Dr Sarah Pearce, a cross-disciplinary trailblazing astronomer and space technologist, for her work to help deepen humanity's understanding of the universe. She leads CSIRO's space program and manages CSIRO's share of the NovaSAR satellite, provided computing expertise for the Large Hadron Collider and contributed to establishing the Australian Space Agency.

Clunies Ross Award for Knowledge Commercialisation (ATSE) 2020

Dr Grant Douglas, for developing and patenting a new phosphorus-adsorbent clay, Phoslock™, which addresses the source of harmful algae in waterways and effectively removes phosphorus without lasting effects or adverse impact on the environment.

ICM Agrifood Award (ATSE) 2020

Professor Michelle Colgrave, for major breakthroughs in analysis of gluten, which causes dangerous auto-immune responses in people with coeliac disease. She leads the Food and Agricultural Proteomics teams at Edith Cowan University and CSIRO, to identify key proteins that will benefit Australia's food and agriculture industries and improve human health.



ICM Agrifood Award (ATSE) 2020 winner: Professor Michelle Colgrave.

Department of Industry, Science, Energy and Resources 2020 Eureka Prize for STEM Inclusion

The CSIRO Indigenous STEM Education Project, for an evidence-based, national initiative that improves Aboriginal and Torres Strait Islander student aspiration, achievement and participation in STEM. The project has reached beyond the walls of classrooms to increase the skills, capability and ambition of whole communities.

National Academy of Sciences International Member

Dr Elizabeth S Dennis, eminent plant molecular biologist, former Chief Research Scientist, Plant Industry and CSIRO Honorary Fellow, elected in recognition of her contributions to plant science.

American Association for the Advancement of Science (AAAS) Fellowship

Dr T J Higgins, for distinguished contributions to the field of molecular plant science, particularly using gene technology to transfer useful traits to grain legumes for food security.

Professor Toby Walsh, for intellectual leadership and significant contributions to automated deduction, constraint programming and fairness in artificial intelligence.

2020 AAAS Newcomb Cleveland Prize for the most impactful research paper of the year in *Science*

Dr Keith Bannister, for leading an international team of astronomers and astrophysicists, which pinpointed the origin of a non-repeating fast radio burst, a discovery that could improve our understanding of the structure of the Universe, as well as galaxy formation and evolution.

2020 Committee on Space Research Harrie Massey Award

Dr Alex Held, one of Australia's leading Earth observation experts, for his pioneering contributions to Earth observation and space research. His work has harnessed satellite imagery to solve real challenges on Earth, including the Sentinel Hotspots program to spot bushfires when they start. The award includes having a minor planet named in his honour.

2020 Food Planet Prize (Curt Bergfors Foundation)

FutureFeed Team led by Dr Michael Battaglia, for developing a seaweed feed supplement to reduce methane emissions from livestock.

Areyonga School (Utju), winner of the Indigenous STEM School Award as part of the Indigenous STEM Education Project.

L'Oréal-UNESCO For Women in Science Fellowship 2020

Dr Marzi Barghamadi, for work developing the next generation of lithium batteries offering higher energy and longer life. Her research will help the commercialisation of lithium metal batteries.

Web of Science Highly Cited Researchers 2020

Dr Wenju Cai, **Dr Josep Canadell**, **Dr Scott Chapman**, **Dr Peter Dodds**, **Dr Elizabeth Fulton**, **Dr Mario Herrero**, **Dr Alistair Hobday**, **Dr Kemal Kazan**, **Dr Evans Lagudah**, **Dr John Manners**, **Dr Alan Richardson and Dr Yingping Wang** were among the most cited authors in their respective fields of study. The Highly Cited Researchers list recognises leading researchers in the sciences and social sciences through the publications indexed in the Web of Science core collection that rank in the top one per cent by citations for their field and year.

The Chairman's Medal for Science and Engineering Excellence

This award recognises teams who have made significant scientific, engineering or technological advances that create value for our customers via innovation that delivers positive impact for Australia.

Australian Centre for Disease Preparedness (ACDP) COVID-19 team, for scientific excellence in foresight, concept, development and rapid delivery of a challenge model and evaluation of candidate vaccines along with associated research, to exacting standards for licensing in the face of the COVID-19 pandemic.

The Sir Ian McLennan Impact from Science and Engineering Medal

This award provides visible recognition of outstanding practical contributions to industry and recognises exceptional individuals or research teams who have created value for customers through innovation that delivers impact for Australia.

The **TraNSIT team**, for pioneering research towards the Transport Network Strategic Investment Tool (TraNSIT) and revolutionising the way Australia's transport-related infrastructure investments are prioritised. The tool is now widely used by all levels of government to inform Australia's largest transport infrastructure projects and initiatives.

The Sir Ian McLennan Impact from Science and Engineering Medal: The TraNSIT team.

CSIRO Medal for Lifetime Achievement

This award recognises individuals who have a record of sustained and meritorious achievements in science, technology and innovation or the support of science, technology and innovation.

Louise Glenn, for outstanding dedication to science support working in a number of business areas within CSIRO including our finance and project support areas. Louise is a great promoter of CSIRO science to staff and stakeholders alike, an amazing ambassador and an advocate for CSIRO's work. Never wanting to stand out as an individual, she acts in the best interests of CSIRO and its staff.

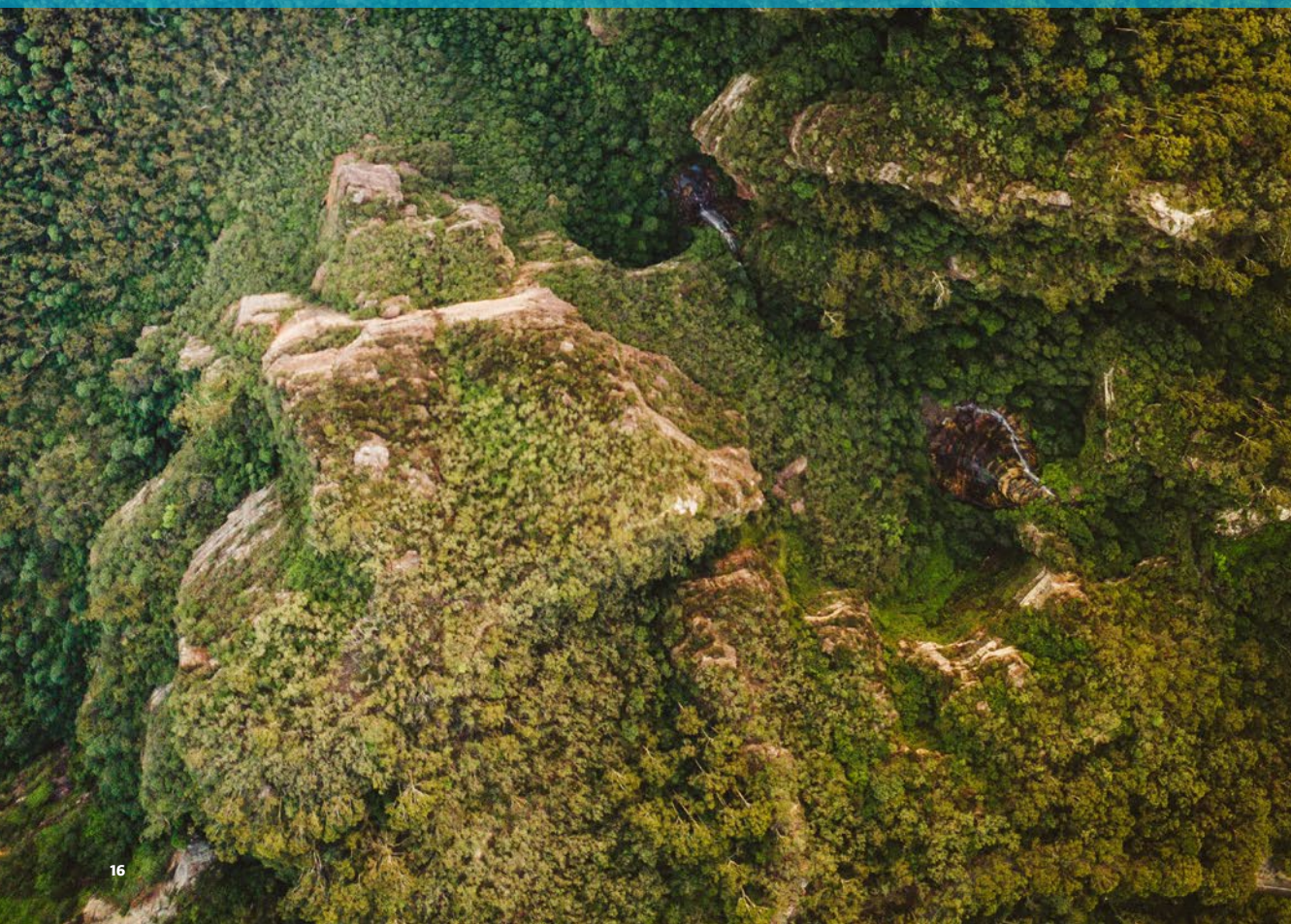
Dr Philip Larkin's CSIRO career spans over 40 years in Plant Industry, then Agriculture Flagship and finally Agriculture and Food working on various crops including sugarcane, sunflower and forage legumes. His research focused on virus and fungal diseases, ruminant bloat, pain relief pharmaceuticals, opiate addiction, bowel health, coeliac disease, and human micronutrient deficiency. The medal recognises his research leadership of several teams delivering impacts, including BYD virus-resistant wheat varieties, synthetic virus resistance genes, improved pharmaceutical poppy, micronutrient-dense rice, gluten-free barley and cereals for digestive health.

Dr Kathleen McInnes, for sustained research excellence since 1990 that has advanced knowledge of how climate change affects sea-level rise, storm surges and severe weather and has enabled communities to understand and adapt to climate change. As a senior researcher leading the Climate Extremes and Projections group in CSIRO's Climate Science Centre, she has developed climate projections for impact and adaptation assessments to assist local government manage and adapt to climate change. She was part of the CSIRO team developing a wave energy atlas for Australian Renewable Energy Australia (ARENA) and is presently a lead author on the IPCC Special Report on Oceans and Cryosphere.

CSIRO Medal for Lifetime Achievement winner: Louise Glenn.

CSIRO Medal for Lifetime Achievement winner: Dr Philip Larkin.

CSIRO Medal for Lifetime Achievement winner: Dr Kathleen McInnes.



Part 2

Sustainability, resilience and recovery

Seizing the opportunity

The world continues to face unprecedented disruption; but disruption creates new opportunities.

Science has shown that it can deliver remarkable solutions to solve our greatest challenges. This enables Australia to better predict and respond to disasters and build a more sustainable future for our people and our planet.

We are enabling a globally competitive Australian hydrogen industry, transforming the way plastic is processed and recycled, keeping our nation safe through the global pandemic, identifying growth opportunities to create a more resilient economy, and building the resilience of our infrastructure and industries.

We know that the science and technology we develop now will set the path towards a brighter future for all Australians.

Enabling citizen scientists to respond to natural disasters

In the aftermath of the 2019–20 bushfires, the Atlas of Living Australia (ALA) was charged by former Minister for Industry, Science and Technology, the Hon. Karen Andrews MP, with mobilising citizen scientists to support bushfire research.

The ALA's approach was to host a series of national forums that brought together key stakeholders across research, state and commonwealth government, non-government organisations, industry and citizen science to explore how the citizen science sector could be supported and coordinated to help deliver research-ready data.

The forums resulted in the development of formal recommendations that were used to support discussions with government and key stakeholders. These recommendations were vital to establishing a consistent approach to harnessing the capability and enthusiasm for citizen science across our organisation and the broader community.

The second step was to develop the Citizen Science Bushfire Project Finder, in partnership with the Australian Citizen Science Association. This resource lists active citizen science projects that can contribute to our understanding of post-bushfire recovery.

Currently, there are 33 projects listed in the project finder and the site has been visited more than 6,000 times since its launch in April 2020. Many projects in the project finder have published papers outlining their findings, demonstrating how citizen science is having an impact on post-fire recovery. Projects such as the Australian Museum's FrogID project and the University of New South Wales' (UNSW) Environment Recovery Project are great examples of projects that have published early results.

ALA's approach has helped enable citizen scientists to contribute research-ready data to help inform disaster response and recovery. The future holds opportunities to facilitate genuine partnerships between communities and researchers to fully leverage citizen science in Australia.

The ALA called on the public and the citizen science community to mobilise and contribute to the bushfire recovery projects. Credit: The Australian Citizen Science Association.

Mission-driven science

When we analysed Australia's threats and opportunities to determine our national challenges, we identified key roadblocks to solving each challenge. Our Missions program aims to break through these roadblocks with innovative science and technology.

These large-scale, impact-focused scientific and collaborative research initiatives will make significant breakthroughs that lead to positive impact, new jobs and economic growth.

We are working with government, universities, industry and the community to reach beyond what is possible today, to bolster Australia's COVID-19 economic recovery and build long-term resilience to future challenges.

We are directing $100 million annually to the co-creation of missions, working with the brightest minds across the research sector and industry to help Australia achieve these outcomes.

Hydrogen Industry Mission

In May, we launched our Hydrogen Industry Mission. The mission's goal is to enable a globally competitive Australian hydrogen industry by 2030 through research, development and demonstration (RD&D) partnerships that activate the market and lower the cost of clean hydrogen to under $2 per kilogram.

It is estimated that a clean hydrogen industry will create more than 8,000 jobs, generate $11 billion a year in GDP and result in avoided greenhouse gas emissions equivalent to a third of Australia's current fossil fuel emissions by 2050.

The National Hydrogen Strategy was adopted by all federal, state and territory governments in 2019. It sets the vision for a clean, innovative, safe and competitive hydrogen industry that helps our nation transition to a sustainable and affordable low emissions future. The Hydrogen Industry Mission will build on this vision.

Success in the mission's goals will:

- promote new major domestic and export industries, creating urban and regional jobs and GPD growth
- help reduce greenhouse gas emissions, particularly in industrial processes
- contribute to a diversified energy system with increased energy security and resilience.

The mission will develop and deliver RD&D projects within the strategic pillars:

- Hydrogen Knowledge Centre – a national resource for industry, government and the research community that highlights Australia's hydrogen projects and provides modelling tools and educational resources.
- Feasibility studies and strategy – delivering trusted independent strategic and technical analysis and advice to de-risk projects in partnership with industry experts and project proponents.
- Demonstration projects – collaborative partnerships that validate hydrogen value chains and de-risk enabling technologies to inform investment and deployment decisions.
- Enabling science and technology – delivering science and technology solutions and socio-economic analysis to remove barriers to hydrogen industry scale-up.

Already the mission has attracted funding from the Victorian government to build a test hydrogen refuelling station on site at Clayton and received $5 million in funding from the federal government to lead an international engagement strategy for the Australian government.

Metal membrane for hydrogen separation.

Waste innovation and a circular economy

A circular economy optimises processes and products to create more sustainable materials management.

Natural resources are kept in circulation, which decreases materials and waste. Materials are reused multiple times across their lifecycle, adding value while also creating new economic opportunities and employment.

A circular economy also has significant environmental benefits by helping to conserve natural resources and reduce emissions and waste.

Charting the path to triple job creation

We are leading the way by advising on how to develop a successful circular economy in Australia – benefiting the environment and creating economic opportunity and jobs in the process.

Recent decades have seen a significant increase in the way we use materials, which is resulting in rapidly increasing waste and emissions, both in Australia and globally.

In January, we provided the Australian Government with the *National Circular Economy Roadmap* for plastics, tyres, glass and paper.

We reviewed these 4 materials, which are common waste streams in our economy. The roadmap focused on innovation and brought together more than 80 industry and government stakeholders to explore circular economy opportunities for Australia.

Innovation is crucial

Innovation is crucial in realising Australia's largest economic gains. This will come from designing new products and materials, including through advanced manufacturing, and in embracing new business models that will create manufacturing opportunities in recycling and clean energy.

This could more than triple job creation from resource recovery in Australia. The recycling sector currently generates 9.2 jobs per 10,000 tonnes of waste, compared with only 2.8 jobs for the same amount of waste sent to landfill.

Increasing Australia's material recovery rate by just 5 per cent would add an estimated $1 billion to GDP. The Australian Government's ban on the export of plastics, glass, paper and tyre waste creates an opportunity for a new circular economy strategy that turns landfill into economic returns.

The roadmap is one of many examples of how we're using science to solve our greatest challenges while driving our economic recovery and building future resilience.

Our circular economy team is exploring research pathways in support of a circular economy. Its objective is to advise how to reduce total waste generated in Australia by 10 per cent per person by 2030 and achieve an 80 per cent average resource recovery rate from all waste stream applying the waste hierarchy by 2030 (National Waste Policy Action Plan 2019).

The recent roadmap aligns with circular economy missions we are developing with our partners in industry, universities and government, including a mission to end plastic waste, a mission to transform Australian mineral commodities into higher-value products, and a mission to transition to net zero emissions.

We are also a partner in the National Environmental Science Program Sustainable Communities and Waste Hub and have provided input to the recycling and clean energy roadmap of the modern manufacturing initiative.

View the full report and summary on our website.

The roadmap aims to reduce single-use paper and address the leakage from low value fibre.

Keeping Australia safe and adapting to life with COVID-19

We have taken a lead role in responding to COVID-19 by partnering with and advising government and industry. The Australian Centre for Disease Preparedness is a key asset in Australia's work on the preclinical testing of potential vaccines and understanding the virus and its variants. Our wastewater monitoring work, support for the manufacturing of vaccines and surgical masks, and analysis of data trends has impacted Australia's ability to respond to the pandemic.

This is part of our effort to future-proof Australia against the impacts of pandemics and support national and global efforts to prevent, detect, respond to and recover from infectious disease.

Through our *COVID-19: Recovery and resilience* report, we looked at the trends and national advantages that COVID-19 has created and how 6 Australian industries – Agriculture and food, Energy, Health, Mineral resources, Manufacturing, and Digital – can capitalise on them over the next couple of years. It calls for Australia to double down on innovation because science and technology can drive our economic recovery from this pandemic and land us back in a much stronger position.

Protecting healthcare workers from COVID-19 aerosols

One of the main ways the COVID-19 virus spreads is via respiratory aerosols and droplets. Aerosols and droplets are generated by coughing, sneezing, shouting, and singing. While droplets fall out of the air quickly, aerosols can remain suspended in the air much longer, travelling on air currents. In the healthcare setting, aerosol-generating procedures such as intubation, extubation, tracheotomy and bronchoscopy increase the risk of virus transmission to healthcare workers.

We set out to inform the safety of Australia's healthcare workers by improving our understanding of COVID-19 aerosol production during medical procedures. We redeployed our aerosol instrumentation that is usually used to measure environmental aerosols related to air quality and climate change in a range of locations around Australia, in the Southern Ocean and in Antarctica aboard research vessels.

Pivoting our research

The team's expertise in measuring aerosols in ultra-clean settings meant they could quickly pivot to this new area of research. They used their specialised instrumentation to measure aerosol generation from a range of procedures in a controlled environment and during surgeries in theatre. This has provided critical information about how much aerosol is generated during a range of medical procedures. Hospital managers are using this information to develop evidence-based guidelines to minimise staff exposure to aerosols produced during medical procedures.

We also tested newly developed personal protective equipment (PPE) to ensure the development of PPE and procedures being deployed in hospitals across Melbourne is research-based. This contributes to the safety of healthcare workers, alleviating their anxiety and improving patient care.

We have expanded our research outside the medical environment and are investigating the production of aerosols during a range of activities, such as while exercising, including in a gym. This research will provide critical information that can be used to guide the development of COVID-safe practices in the ongoing management of public safety during the pandemic and into the future.

We redeployed our environmental aerosol monitoring instruments to understand how healthcare workers can be safety protected from COVID-19 aerosols in medical settings.

Wastewater testing

COVID-19 sewage surveillance is a powerful tool to inform public health professionals about the presence of infection in a community, supporting strategies for minimising community transmission and reopening economies.

Building on our published work with researchers from the University of Queensland (UQ), wastewater testing has been deployed to augment clinical testing to aid health professionals in predicting and managing COVID-19 community outbreaks.

This work based at our Brisbane P2 BC2 laboratory at Dutton Park has also informed measures to track the movement of COVID-19 through the community, and from long-haul planes and ships.

Tracking COVID-19 in communities

Through this work Australians have come to understand wastewater testing, known as wastewater-based epidemiology, and how it helps track disease in communities, providing knowledge and confidence about the process.

The testing uses samples of sewage to look for fragments of SARS-CoV-2's genetic code, which serve as a 'fingerprint' of the virus. These unviable fragments end up in wastewater when infected people flush faeces down the toilet. The virus is shed through faeces about 3 to 5 days before a person typically displays symptoms of COVID-19, if at all. People can continue to shed the virus for 6 to 8 weeks after falling ill.

Our researchers now are working to improve and standardise testing protocols and applications, such as testing wastewater samples from repatriation flights operated by Qantas. We are also working on developing new and innovative techniques for wastewater sampling and virus concentration, as well as improved detection methods.

Dr Warish Ahmed uses digital polymerase chain reaction techniques in our Brisbane laboratory to quantify genetic fragments of the COVID-19 virus in sewage.

Wastewater monitoring results are highly accurate for detecting the virus signals in the community from symptomatic and asymptomatic COVID-19 infected individuals.

Wastewater surveillance strategies will remain vital for preventing new outbreaks and managing future pandemics as well as more traditional targets, such as seasonal flu and antimicrobial-resistant bacteria.

In the future, we hope to provide crucial information to public health authorities about a greater range of dangerous pathogens circulating in our community, allowing public health interventions to mitigate human health risks.

Understanding SARS-CoV-2 survival at different temperatures

Throughout 2020, scientists conducted research on SARS-CoV-2, the virus responsible for the COVID-19 disease pandemic.

While the main cause of person-to-person SARS-CoV-2 infection is via aerosols and respiratory droplets, we know from studies on other viruses that transfer can occur from contaminated objects to people.

Contaminated surfaces

To better understand the role that contaminated surfaces could play in transmitting SARS-CoV-2, researchers at our Australian Centre for Disease Preparedness conducted a series of experiments. They studied the survival rates of infectious SARS-CoV-2, suspended in an artificial mucous solution, and dried on 6 common surfaces. The surfaces used in the study were stainless steel, glass, vinyl, both paper and polymer banknotes, and cotton cloth.

The experiments were carried out at 3 different temperatures – 20°C, 30°C and 40°C – with the relative humidity kept at 50 per cent.

As other studies have found that sunlight rapidly inactivates viruses, the work was conducted in the dark to reduce the number of variables that might impact virus survival.

At 20°C, which is about room temperature, we found that the virus was extremely robust, surviving for around 2 weeks in quantities able to infect someone and was detectable for up to 28 days on glass and plastic banknotes.

Our knowledge that the virus survives longer at colder temperatures may help to explain the spread of SARS-CoV-2 in environments such as meat processing facilities.

This research informed a better understanding of how SARS-CoV-2 behaves and for determining the risks of transmission via contaminated surfaces. It also helps us better understand the conditions in which SARS-CoV-2 can stay active on surfaces, to improve targeted disinfection and deactivation methods.

Droplets of SARS-CoV-2 in artificial mucous were applied to test surfaces. This work was done within the highly secure Biosecurity Level 4 laboratories at our Australian Centre for Disease Preparedness.

Manufacturing an Australian-produced COVID-19 vaccine candidate

The emergence of COVID-19 presented many challenges including finding a safe and effective vaccine.

Our work centred on preclinical trials at the Australian Centre for Disease Preparedness and on scaling up The University of Queensland's (UQ) vaccine candidate for phase one clinical trials. Researchers at our Advanced Biologics facility in Melbourne worked with UQ, CSL and many other organisations to shorten the process, which has previously taken years, to a few months.

Scaling-up

While the UQ team refined the vaccine candidate, our Melbourne research team, in collaboration with industry partner CSL, began the purification and were able to scale-up the antigen from half a litre to 20 litres so it could undergo toxicity studies and other tests. This meant we could explore whether the vaccine candidate was likely to be effective and safe before UQ's bioengineered cells arrived at our lab.

The combined team successfully manufactured the UQ vaccine candidate at a volume where it could progress to human trials.

While the vaccine produced a robust immune response, it did not progress beyond the Phase I trial due to the molecular clamp component used in this candidate interacting with specific human immunodeficiency tests, which caused false positive results.

We continue to work with UQ and their molecular clamp technology, and it may feature in future vaccines. The expertise, processes and production methods, speed and parallel working techniques are transferable as we continue to fight COVID-19 and prepare for the next global pandemic.

Working with CSL at our Clayton site growing the protein, culturing cells and running the reactor.

Sustaining Australian food systems through a pandemic and beyond

When the COVID-19 pandemic hit, businesses in the Australian food system were nervous. Concern mounted over whether we would still have the quantity and diversity of foods to which we had become accustomed. Questions arose as to whether there would be enough labour for harvesting crops and whether shipments of seeds and chemicals would arrive in time. We were even unsure how our exports would be affected.

With little data and limited precedent to make predictions and guide decision-making, we embarked on research to assess, understand and identify ways to support agribusinesses and government to build resilience and recovery right across the system.

Supply chains

The Australian Agriculture COVID-19 Supply Chain Resilience project was a cross-disciplinary effort, drawing on our researchers, modellers, economists and engineers. It focused specifically on supply chains for beef, poultry and citrus.

We drew on our capability developed over many years looking at how other disruptions such as droughts, floods and storms affected national food production and food security as well as critical input and labour markets. Our research had already identified vulnerabilities in the food system, and many feared these would be exacerbated by the pandemic.

Desktop analysis and interviews with agri-businesses across input markets, production, processing, export markets and domestic buyers revealed that COVID-19 brought new challenges, such as consumers demanding new or different products for cooking from scratch at home. It also exacerbated long-standing farm production issues such as access to labour.

Most businesses managed to keep sufficient quality food products flowing to Australian consumers, even during the peak period of crisis. They relied heavily on longstanding trading relationships, domestically and globally, and benefitted from fortunate tailwinds, including a plentiful global grain market and late disease onset for key Australian harvest periods.

The complexity or length of a supply chain appeared to have little impact on success or failure. Global firms benefitted from early warnings and experience managing COVID-19 outside Australia. Smaller local businesses with shorter supply chains took advantage of new opportunities to supply Australian retailers with local products when imported products faced transportation challenges.

Our work has identified 2 new areas of research for developing a healthier, more resilient and sustainable domestic food system. Firstly, innovative ideas around solving existing and exacerbated labour challenges in horticulture will be key to reaching the national goal of a $100 billion industry by 2030. Secondly, new evidence-backed thinking for agile, flexible food value chains that can adapt to new consumer preferences and challenging purchasing behaviours are required to support domestic producers, traders and retailers.

This research has informed ongoing strategic value chain work that we conduct with partners, including the Australian National University (ANU), the Australian Centre for International Agricultural Research, and the Department of Foreign Affairs and Trade (DFAT).

COVID-19 almost halved the available agricultural labour workforce in Australia.

Economic recovery

Australian manufacturing is transforming, and we've been working with industry, government and researchers to identify major growth opportunities to create a more resilient economy for the nation.

We're developing innovative products and processes that allow Australian manufacturers to be globally competitive and environmentally sustainable.

We are supporting work led by the Department of Industry, Science, Energy and Resources (DISER) to implement the Modern Manufacturing Strategy, which is a whole-of-government strategy aimed at helping Australian manufacturing scale-up and become more competitive and resilient – creating jobs for now and future generations. As the national science agency with a long-standing history of working with Australian businesses, we are supporting the development of industry-led roadmaps and ensuring science and technology help manufacturers leverage economies of scale, knowledge transfer and innovation.

Australia's first accredited surgical face mask testing facility

In August, we opened Australia's first accredited single-use surgical face mask testing facility. The facility enables manufacturers to test their products to Australian and international standards in Australia, which was invaluable during the pandemic when international supply chains were disrupted.

When COVID-19 reached Australia and the demand for masks surged, the local gap in testing became apparent. We pivoted quickly and assembled an expert team and developed the 3 tests required for manufacturers to meet Australian standards.

International and Australian standards

Synthetic Blood Penetration (ISO 22609:2014): The Synthetic Blood Penetration Test determines how well a mask can act as a barrier against blood-borne pathogens. A volume of synthetic blood is sprayed at the centre of the mask at high velocity. This measures the mask's ability to stop blood penetrating through the mask.

Bacterial Filtration Efficiency (EN 14683:2014 Annex B): We conducted Bacterial Filtration Efficiency testing on face masks to provide protection against biological aerosols. This test determines whether biological organisms can penetrate the filtration fabric used in a mask.

Pressure Differential (EN14683:2014 Annex C): The Differential Pressure test measures the differential pressure of air on either side of the test material. This test determines the breathability of a mask.

After we developed the tests, Australia's laboratory testing authority, the National Association of Testing Authorities, conducted a rigorous on-site review of our testing methodology and officially accredited our facility. Manufacturers were able to have their products added to the Australian Register of Therapeutic Goods, which ensured Australia's frontline staff were protected through the supply of these vital pieces of protective equipment.

Our facility boosted Australia's sovereign capability to produce essential medical supplies more efficiently and at a lower cost. Manufacturers no longer need to go overseas for accredited testing, which saves time and money.

A scientist conducts a Pressure Differential (pressure drop) test to assess breathability by measuring the differential pressure across a mask.

Climate and disaster resilience

Over the past couple of years, we have seen consecutive and at times coincident natural events involving a confluence of bushfires, floods, drought and heat extremes. Their cascading effects have impacted Australian communities and industries through loss of life and significant costs to the community and government.

To better understand and predict the interplay of these natural events and the challenges, risks and impacts they present, we provided a report to the Prime Minister on practical options for Australian governments to support and improve Australia's climate and disaster resilience. The report made recommendations on how to build Australia's climate and disaster resilience and is underpinned by our science and long-term experience.

As an organisation and consistent with our own science and technology, our environmental strategy delivered the first significant reduction of our emissions in history. To reach our goal of net zero by 2030 and beyond net zero by 2050, we are exploring innovative options, such as using hydrogen to power future research vessels and applying renewable or hybrid energy to power remote facilities.

One House to save many

Destructive bushfires are a global problem, resulting in loss of life, property and infrastructure in many countries. The increase in fire season severity and the expansion of the Wildland Urban Interface has dramatically increased the consequence of bushfires in recent decades.

The Australian summer of 2019–20 was defined by a series of extreme natural events. In south-eastern Australia, 33 people died in bushfires, including 9 firefighters. A total of 3,094 houses were lost.

The financial costs were also significant. Insurance losses alone from the fires exceeded US$1.79 billion, while the costs of one flooding event in Australia's north in 2019 exceeded US$4.36 billion.

Key partners

To address this, we worked with Suncorp, James Cook University and Room 11 Architects to design, build and test a prototype house resilient to multiple extreme events, including bushfires. The result was One House.

At our Bushfire Burnover Facility and at James Cook University's Cyclone Testing Station, researchers tested which aspects of the house would fail or resist fire, cyclone and flood impacts.

The bushfire simulator produced a 12-metre-wide fire front to replicate fire in a series of simulations. Up to 100 sensors were embedded in and around the house prototype to measure air and surface temperatures and radiant heat flux and track how individual elements of the house survive different fire intensities.

The results of One House collaboration, research and testing have enabled us and our partners to qualify specific design principles and demonstrate how clever use of design and material selection can dramatically increase the resilience of a home. This has led to a more robust and resilient house design that can help to protect against extreme weather.

Having a liveable house after a fire passes through addresses 2 very practical problems. It ensures people are not left homeless and gives people the confidence to leave their houses undefended in the face of a fire, potentially saving lives.

The collaborative One House project was the first research of its kind to test housing resilience to multiple extreme events.

Part 3

Annual performance statements

Introductory statement

The CSIRO Board, as the accountable authority of CSIRO, presents the 2020–21 annual performance statements as required under s39 (1) (b) of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act). These annual performance statements are based on properly maintained records and accurately present CSIRO's performance in accordance with s39 (2) of the PGPA Act.

Delivering on our purpose

Our overarching outcome is to produce innovative scientific and technology solutions to national challenges and opportunities to benefit industry, the environment and the community through scientific research and capability development, services and advice.

Our Corporate Plan objectives help us deliver on our purpose and respond to the internal and external environment.

OBJECTIVES	STRATEGIC OUTCOMES
1. Conduct and encourage the uptake of world-class scientific research.	Triple-bottom-line impact to Australia
2. Mobilise and develop the best talent, for the benefit of Australia.	Lift Australia's science capacity and capability
3. Manage national research infrastructure for the nation.	Accessible world-class facilities to underpin research and innovation
4. Ensure the sustainability of CSIRO.	Sustainable operations, cultural health, safety and wellbeing

Revenues from our partnerships, business and commercialisation activities described in this section are summarised in Table 3.1.

We have been successful in managing the financial disruption caused by the COVID-19 pandemic to deliver an operating surplus of $76.9 million, which is better than the budget surplus approved by the Australian Government. This was achieved through careful financial management, with total expenses of $1,383 million, externally generated revenue of $500 million and government appropriations of $961 million.

Results

This section of our annual report provides evidence of our results against the activities and performance measures set out in our Corporate Plan 2020–21 and the Portfolio Budget Statements 2020–21.

Table 3.1: Investment in our research by source, $m

REVENUE SOURCE	2016–17	2017–18	2018–19	2019–20	2020–21
Australian private sector	86.9	84.4	85.9	86.4	88.7
Australian governments	165.6	173.9	208.9	208.8	213.4
Rural industry research and development corporations	38.7	42.7	44.5	38.2	35.6
Cooperative Research Centres	12.0	9.1	9.8	9.5	9.6
Overseas entities and international	80.7	93.6	93.2	98.6	75.3
Work in progress/deferred revenue	-9.3	-2.8	-8.9	-9.2	-26.7
Total co-investment, consulting and services	**374.7**	**400.8**	**433.4**	**432.2**	**395.9**
Intellectual property (IP) – royalty and licence revenues	51.1	43.2	34.4	28.6	38.9
Total research and services revenue	**425.8**	**444.0**	**467.8**	**460.8**	**434.8**
Other external revenue	57.3	55.1	48.6	40.6	26.0
Gain/(loss) on sale of assets	0.9	0.1	11.5	1.6	2.5
Other fair value gains and reversals	–	–	1.1	40.8	36.2
Total external revenue	**484.0**	**499.2**	**529.0**	**573.4**	**499.6**
Revenue from government*	787.3	793.5	834.6	837.9	960.5
Total revenue	**1,271.3**	**1,292.7**	**1,363.6**	**1,381.6**	**1,460.1**
Less expenses	1,292.1	1,352.5	1,396.4	1,388.6	1,383.2
Operating result	**-20.8**	**-59.8**	**-32.8**	**-7.0**	**76.9**

*See note 1.2F in the financial statements

Objective 1:

Conduct and encourage the uptake of world-class scientific research

Our first objective is addressed by 3 key requirements:

REQUIREMENT		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
1.1	Conduct and facilitate the uptake of excellent scientific and technology solutions to deliver impact to the nation.	Pages 40–65	Pages 66–69
1.2	Connect to global science, technology and innovation to access new opportunities for Australian innovation.	Pages 70–76	Pages 76–77
1.3	Manage funding directed to industrial scientific research activities, commercialisation of technologies and assistance to industry through research collaboration and capacity building.	Page 79	Pages 81–82

The outcomes expected from this objective:

1. The application of research benefits the Australian economy, society and environment.
2. The provision of timely advice, information, and specific solutions inform and protect society and the environment.
3. New knowledge and solutions are available to be used by academia, government and customers.
4. Strong relationships with universities and other research organisations enhance Australia's innovation capacity.
5. We are trusted as the national science agency and have a reputation for world-class pioneering research.
6. We are recognised as being part of 'Team Australia' in global markets' access to world-class capability and talent.
7. Links for our Australian SMEs and domestic university partners to global markets.
8. Increased value creation for our innovations and services.
9. Australian industries maintain and improve their competitiveness through the application of new technologies and solutions.

Enabled by technological advancement in robotics, data handling, sensors and automation, the CSIRO BioFoundry can quickly prototype new biotechnologies or answer complex biological questions.

1.1: Conduct and facilitate the uptake of excellent scientific and technology solutions to deliver impact to the nation

Our key activities helped us achieve our strategic direction and aspirations:

- Mission program establishment
- Digital transformation
- Improved approach to portfolio management
- Customer growth and retention
- Responding to COVID-19
- Australia's climate and disaster resilience
- State of the Climate report
- Great Barrier Reef.

We delivered on this requirement by:

- conducting scientific research aligned to the greatest challenges and encouraging or facilitating the application or utilisation of the results
- establishing collaborations and multidisciplinary research partnerships (with public and private sector organisations, other publicly funded research agencies, universities and schools) to integrate the best solution for our customers
- providing products and technical and advisory services to industry and government, including professional consulting and testing facilities.

Conducting scientific research aligned to key national and global challenges

Impact for Australia

Impact is central to our purpose and represents the value created for Australia by the public and industry funding of CSIRO. To achieve impact, we collaborate with other researchers and partners within industry and government bodies that adopt our research.

We use the term 'impact' to define an effect, change or benefit to the economy, society or environment. It arises when industry, government and society implement and use our research outcomes.

To measure and assess our impact, we take an in-depth case study approach to evaluate the diverse benefits from our research activities. Our Impact Evaluation Guide articulates a common framework, ensuring consistent and rigorous use across our organisation.

This method provides an opportunity to learn from detailed accounts of if and how impact was delivered, leading to a deeper understanding of the mechanisms of systemic change. Case studies are validated by external experts and published on our website.

We also regularly commission an external assessment of the overall value we deliver to the nation, mainly drawing upon the aggregated impact of case study findings. The most recent finding, from an independent study concluded in June 2020, reports our return on investment to the nation as 7.6:1. The results from the next independent study will be available in June 2022.

This return on investment has been underpinned by a strong capacity to deliver impact through durable and trusting relationships, a solid understanding of the problems facing our customers and the nation, as well as a deep commitment to building not just our own capability but also that of those in industry, government and the community when it comes to STEM knowledge and skills. When all these factors combine, uptake and adoption of our collaboratively created solutions is more effective, resulting in greater impacts for Australia.

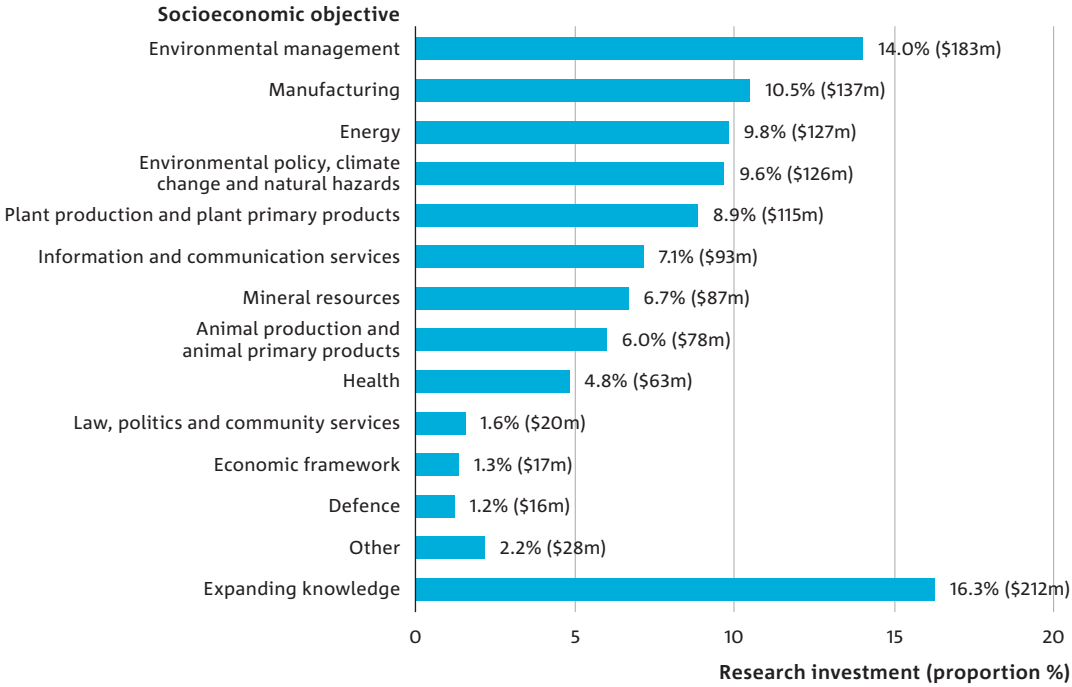
Figure 3.1 shows the contribution of our research efforts towards socioeconomic benefits during the year.

Partnership with governments

We actively partner with state, territory and local governments to assist them in their roles as policy makers and service deliverers. We are a trusted advisor to support policy formation and a partner to deliver research programs that are solving the greatest national challenges.

We assist governments to leverage Commonwealth programs for the benefit of Australian industry and the Australian community.

Figure 3.1: Our research investment (proportion % and $ spend) by socioeconomic objectives



The Other category includes: Culture and society; Transport; Construction; Indigenous; Commercial services and tourism; and Education and training. Total spend ($1.3 billion) includes all BUs and National Facilities excluding CSIRO Services. Expanding Knowledge mostly include the R&D that does not have an identifiable socio-economic objective. This is usually the case for pure basic research or strategic basic research type of activity classification.

We have focused on a greater engagement with government through our relationship managers located in each state and territory, which has improved the awareness of our impact and enabled our capabilities to be better understood. Government has sought our assistance in priority areas, such as natural disaster resilience, COVID-19 recovery and the Federal Government's Modern Manufacturing Strategy.

Here are some examples of our government collaboration this year.

Victoria

We have delivered new projects in collaboration with the Victorian Government and local partners. Announced in January, the Clayton site Victorian Hydrogen Hub is a strategic partnership with the Victorian Government and Swinburne University that will test, trial and demonstrate new hydrogen technologies. Read more about the Victorian Hydrogen Hub on page 54.

We provided crucial scientific insights to the Phillip Bay Coastal Hazards Assessment for the Victorian Department of Environment, Land, Water and Planning. This has assisted state and local governments to better understand, plan and manage the impacts of climate change on Port Phillip Bay communities and industries.

South Australia

We have built on our strategic relationship agreement with the South Australian government to apply research and innovation to key sectors, such as energy, space and minerals.

Our AquaWatch mission is working with stakeholders to pilot a system to collect data from remote sensors combined with Earth observation satellites to support monitoring and managing water quality in one of South Australia's key aquaculture regions.

The pilot will test ways to combine the field and satellite data as well as tools for analysing, modelling and forecasting environmental effects.

Our trials with power networks continue. We developed technology to demonstrate the ability to improve customers' power quality, increase the amount of solar that can be connected to the network and allow emergency demand reductions during supply shortages.

New South Wales

We committed to consolidating our Sydney sites to align with the Metropolis of Three Cities – the Greater Sydney Region Plan. In the coming year, a new site in the Westmead Health and Innovation District will extend our health capabilities to NSW. We plan to locate our Sydney headquarters at Bradfield/Aerotropolis from 2026, and we are expanding our site at Tech Central in Eveleigh. We are delivering Mission-related projects in the NSW Special Activation Precincts under a Memorandum of Understanding (MOU) with the Regional Growth NSW Development Corporation and a MOU with the NSW Department of Primary Industries.

Queensland

We continue to build the Australian e-Health Research Centre (AEHRC) to be a national centre with its headquarters in Queensland. The AEHRC offices moved to the new Surgical, Treatment and Rehabilitation Service hospital on the Herston Health Campus, to provide the opportunity for new collaborations. The AEHRC continues to partner with Queensland hospitals and health services, including support for COVID-19 data modelling, mobile health for over 1,000 women with gestational diabetes and medical imaging studies. The AEHRC is working with us as part of the Antimicrobial Resistance Mission to establish a Queensland hub as a test bed for technologies to improve use of antibiotics across human, animal and environmental health.

Partnership with industry

Businesses work with us to improve competitiveness, reduce risk, expand markets, and develop new industries based on our research. The partnerships we form with our customers enable us to encourage the uptake of our world-class scientific research.

This year we collaborated with small and large businesses, government bodies, international organisations and universities.

We continued to adopt a range of commercialisation pathways to take our research to market, including licensing our intellectual property, providing research in exchange for equity, embarking on joint ventures and establishing spin-outs.

We worked closely with customers as they responded to the evolving operating environment created by COVID-19. We implemented a range of customer-focused initiatives designed to deliver a more holistic engagement experience, building on the implementation of our Strategic Account Managers.

During 2020–21, more than $618 million, across more than 1,700 commercial contracts, was committed to be invested in our research and services. Despite the disruptions of COVID-19, the value of our contractual activity is higher than last year, with the average contract value of $358,000 higher than the 5-year average. We engaged with over 3,900 industry and government entities, attracted 944 new customers, and retained repeat and ongoing business from more than 3,000 customers.

We continued to develop our Commercialisation Marketplace portal, which generated 21,000 site interactions over the year. The updates make it easier for companies to explore our pipeline of investment and partnership opportunities, as well as a range of licensing options, to catalyse innovation and create competitive advantage.

Science excellence

The high quality of our research is central to the value we provide to the nation. It is the foundation that enables us to partner with industry, government and society to achieve impact for Australia.

Disseminating excellent science demonstrates how we deliver on our purpose to solve the greatest challenges through innovative science and technology. The conduct and dissemination of strong science not only indicates high-quality scientific capability within our organisation but also drives profound real-world impact.

Research publications

A standard way of evaluating scientific performance is to look at the publications produced from research and how often they have been cited by others. We measure our excellent science by looking at how frequently our work is cited and normalised for subject patterns and the age of the material. This Normalised Citation Impact (NCI) is a standard indicator and allows for global comparison.

Our metrics show citation levels that are significantly higher than global average. Our NCI performance in the fields for which we deliver crucial impact remained strong; we are ranked in the top 0.1 per cent of institutions globally in the fields of Agricultural Science, Environment/Ecology, Geoscience, and Plant and Animal Science based on total citations over the last 10 years. We have held this position in these 4 fields for 16 years – for as long as we have tracked this performance. More than half of our publications appear in these 4 fields. We are also consistently ranked in the top one per cent of global institutions in 15 of 22 fields.

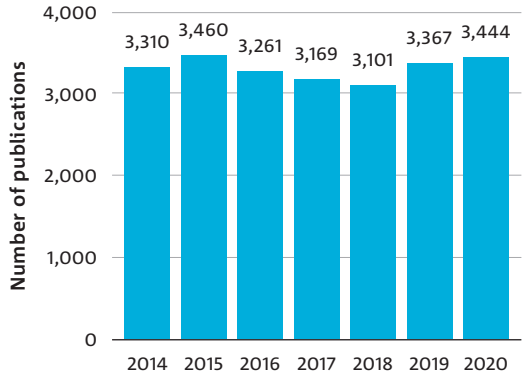
Figure 3.2 shows 5 of our major fields of focus and how strong our publications are for each and how much we contributed to Australia's output. For these 5 fields, we author at least 10 per cent of the country's publications, indicating a core role in the nation's research activities. We are at least half again more cited than the global average in these fields, except Environment/Ecology, where we are twice as cited as the global average.

This year, we launched the Reporting and Improving Science Excellence project, which benchmarks each Business Unit's key fields against lists of peer institutions working on similar problems and with similar objectives. This segmentation, which overcomes variation in citation patterns among and within fields, allows us to better evaluate the level of science excellence required to underpin the delivery of profound impact. We will capture reporting in next year's annual report.

As shown in Figure 3.3, our publication output continued to increase from 3,367 in 2019 to 3,444 in 2020.

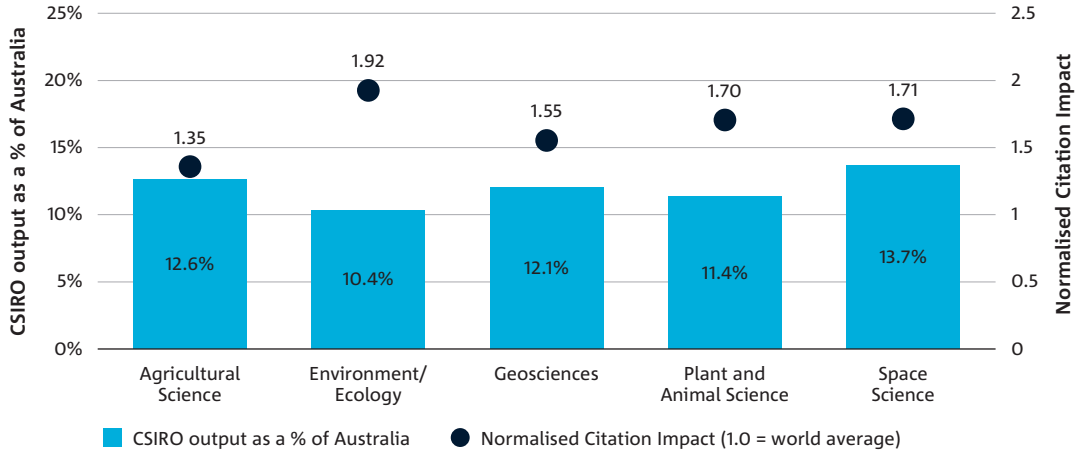
The earlier decline was due to the decrease in our research staff in previous years, lagging that change because of the time it takes to conduct and publish research. This year's rise in output is expected to continue as it reflects the gradual increase in staff after 2015. While the bulk of our publication output takes the form of peer-reviewed journal articles, we also produce conference proceedings, along with some book and online materials. We also author and release numerous client and technical reports each year.

Figure 3.3: Our journal publication output



Source: Web of Science, Articles and Reviews, All Indices excluding ESCI

Figure 3.2: Our top research fields and their citation impact



Future Science Platforms

A key mechanism to solving the greatest challenges is our investment in cutting-edge, transformative horizon-3 research.

Our Future Science Platforms (FSPs) are multidisciplinary investments that are reinventing existing industries, creating new industries for Australia and providing a better future for us all.

These strategic initiatives are turning the greatest challenges into opportunities, where innovative science and technology can break through seemingly impossible problems to improve Australia's sustainability and prosperity.

Through FSPs, we're also growing the capability of a new generation of researchers and allowing Australia to attract the best students and experts to work with us on future science.

Since 2016, we've invested in 13 areas of promising new science under our FSPs. Together with our partners, we've developed new technologies and platforms that are changing the way we live. When an FSP cycle is concluding, the newly developed technologies are transitioned into our Business Units. This allows us to introduce new FSPs and new science to be developed.

To date, we have invested $250 million in FSPs, and this year the program grew to a total annual investment of $90 million.

180+ early career researchers supported

680+ articles published

35+ patents filed

Round 1

Active Integrated Matter
2017–21
Where material things meet the digital world

Synthetic Biology
2017–22
Establish the next generation of synthetic biology technology and leaders

Deep Earth Imaging
2017–24
Imaging, conceptualising and predicting location and character of the Earth's deep resources

Digiscape
2017–22
Harnessing the digital revolution for Australian farmers and land managers

Environomics
2017–25
Using genomics to reinvent how we measure and monitor ecosystems

Probing Biosystems
2017–21
Real-time interrogation of living biological systems

Through our Environomics FSP, we developed a new way to collect environmental DNA from waterways using membranes, which are small pieces of cellulose filter paper.

Round 2

Responsible Innovation
2017–23
Delivering responsible science and technology for all Australians

Precision Health
2018–23
Transforming Australia's health

Hydrogen Energy Systems
2018–23
Sustainable hydrogen production, transport and use

Round 3

Space Technology
2019–23
Growing Australia's space capabilities

Artificial Intelligence and Machine Learning
2019–23
Data science for artificial intelligence and machine learning technology development

Round 4

Quantum Technologies
2021–25
Translating fundamental quantum research to address real world problems

Microbiomes
2021–25
Interconnectivity of microbiomes across systems for One Systems Health

Monitoring brain cell death in brain injury

As neurons die, their DNA is cleaved and fragmented by nucleases and released into the blood as circulating cell-free DNA (ccfDNA). ccfDNA is normally present at low levels in the blood of healthy individuals; however, it is significantly increased following physical trauma or the presence of neurological disease.

Genetic marker

The origin of the ccfDNA is identified using tissue-specific methylation marks at specific genetic locations on the ccfDNA.

Through our Round 1 Probing Biosystems FSP, scientists have discovered DNA methylation patterns specific to the brain. This can be exploited to develop sensitive molecular assays that quantify the ccfDNA fraction arising from recent brain cell death, thereby providing specificity. This assay would be delivered to the market as a pathology-based test.

Pathology test

The test, called 'NeuroLiB' (Neuro-Liquid-Biopsy), is being validated in a prospective clinical trial in patients with traumatic brain injury (TBI). TBI is a leading cause of death and disability in Australia and worldwide. Many individuals can suffer long-term impairment and disability. Precise, early assessments of brain injuries will greatly assist in managing future patients.

A new test could diagnose traumatic brain injuries.

Helping sugarcane farmers protect the Great Barrier Reef

Through our Round 1 Digiscape FSP, we are developing a suite of apps, called 1622™, to deliver information services to farmers that address their concerns, make for faster change in farm management practices and help growers reduce impacts of cropping on the GBR. Our 1622™ apps are at different stages of product development. Our first app, 1622WQ™ (water quality), was released in January 2020.

1622™ uses sensors, advanced data analytics and state-of-the-art deep learning to help sugarcane farmers manage nitrogen fertiliser without affecting profits, with flow-on benefits for the health of the Great Barrier Reef (GBR).

Nitrogen losses from intensive crop production into wet tropical catchments of north Queensland are a major threat to the health of the GBR. However, owing to the lack of information on these losses and the extreme variability in climate and rainfall over very small distances, it's been difficult for growers to link nitrogen that appears in the environment and nitrogen management on their farm. There's also been the expectation that changing fertiliser management practices could affect crop yields.

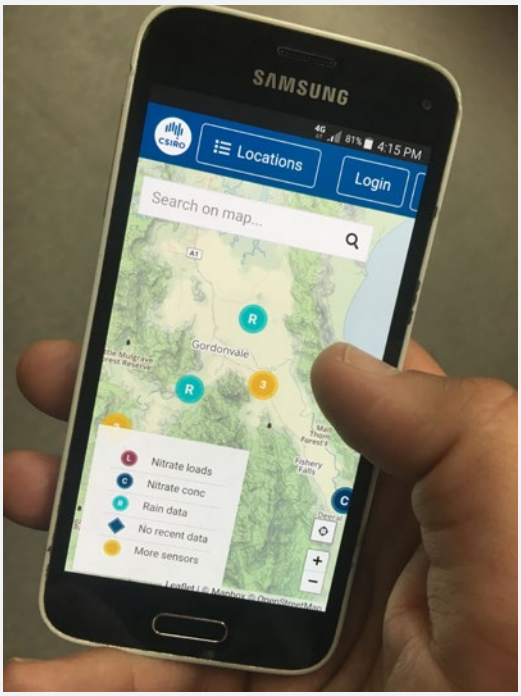
1622WQ™ uses water quality sensors, our cutting-edge advanced data analytics and user-centred software design to show nitrogen concentrations in local waterways of far north Queensland. This helps sugarcane growers understand fertiliser loss from their properties and potentially reduce nitrogen runoff onto the Great Barrier Reef.

1622WQ™ provides real-time water quality information. It allows farmers to see, for example, the influence of recent rainfall on water quality and whether management actions, such as recent fertilising, has affected nitrogen losses. Farmers can also see the seasonal climate outlook to help plan ahead.

The 1622WhatIf?™ function of the app allows farmers to evaluate the risks and benefits of changing nitrogen fertiliser applications. For example, 'What if I change my fertiliser rate, harvest date and/or fertilising date, and how would that affect my crop yields and nitrogen losses?'

1622Crop™ uses our drone-based light imaging, detection and ranging (LiDAR) system, satellites and other novel sensing technologies to help farmers use less nitrogen-based fertiliser without affecting their profits. Growers can compare different management strategies in real time through the season.

For the first time, farmers now have real-time information on key factors for growing sugarcane. 1622WQ™ brings together information on sugarcane production and environmental performance to help farmers evaluate their crop management, facilitate better decisions and help them protect the GBR.



For the first time, farmers now have real-time information on key factors for growing sugarcane.

Future Science and Technology

To ensure that we have a clear, long-term science and technology direction, our Future Science and Technology plan provides guidance on what science and technology capabilities we need to develop to deliver on our purpose. It acknowledges that research and engineering methods are shifting rapidly as digital disruption, non-classical-quantum sciences, and multi- and interdisciplinary science and technology accelerate the pace at which we can shape the future and solve our greatest challenges.

Cross-cutting capabilities

We established 7 cross-cutting capabilities, appointed leaders and created communities of practise to foster professional development and improve organisational capabilities. We are planning to establish 3 more by the end of December 2021.

Labs of the Future

Future Science and Technology is also ensuring that we keep pace with expected changes in the use of laboratories and scientific equipment. We established Labs of the Future to guide how and where we deliver our science. Labs of the Future is in the early stages of development and is leading with pilot projects so that we can make the most effective use of our laboratory spaces. This will improve collaborations and adopt and share digital technology that is quickly evolving and enabled by digital disruption, such as adoption of robotics, artificial intelligence (AI) and machine learning.

Commercialising our intellectual property

Intellectual property (IP) in its different forms is the output of our research. Managing and protecting IP is crucial when we are translating our research into commercial products.

FutureFeed, a company we formed, is commercialising a natural livestock feed additive (FutureFeed®) based on the seaweed Asparagopsis. The additive can reduce methane emissions in cattle by more than 80 per cent and improve feed efficiency and productivity. The IP, which we co-own with Meat & Livestock Australia and James Cook University, has produced 2 patent families, an Australian trademark registration and a domain name that are licenced or transferred to FutureFeed. In August, we signed final investor agreements in a transaction valued at $13 million. Read more about our partnerships and involvement in Rural Research and Development Corporations on page 62.

Commercialisation strategy

To maintain our portfolio of protected IP, at the end of June we had 658 active patent families, 312 trademark families and 87 plant breeder's right (PBR) families. There was a consistent level of new patent and PBR filings during the year and we also saw an increase in design filings. These are good indicators of existing technologies making their way through the pipeline, and it highlights our continued focus on our commercialisation strategy. We filed 53 new provisional applications, which is comparable to previous years and a good result given the difficulty of conducting lab-based work during COVID-19 shutdowns.

To indicate how much of our IP is in use, just over half of our patent portfolio is either subject to a research right; arose as a result of collaborative activity; was used as background IP in a collaboration or evaluation; or is the subject of a commercial licence.

Technology licences are used as key indicators of research and development uptake by customers and collaborators. This year, the total number of revenue-bearing licences remained steady at 300.

New IP licences will have a positive impact on Australian industry and contribute to the strength of our IP commercialisation revenue stream. This year, we licensed Smarter Safer Homes technology to HSC Technology Group to allow older Australians living independently at home to send real-time data to their healthcare providers through a new non-invasive, secure and transparent health monitoring solution.

We also licenced a drug delivery technology to IDE, who is developing a control sleeve to make intravitreal injections – injections made into the retina at the back of the eye – safer and more accurate.

Eden Brew

Over the past few years, we commercialised plant protein burgers with our partner, v2food, a company we formed with Main Sequence and Hungry Jacks. Following this success, we cofounded a new company, Eden Brew, with Main Sequence and Norco. Eden Brew is commercialising milk that is produced synthetically using processes that our researchers developed.

Eden Brew's milk prototype.

Table 3.2: Our intellectual property portfolio

IP CATEGORY	SUB-CATEGORY	2017–18	2018–19	2019–20	2020–21
Patents	Provisional applications	53	55	64	53
	Patent Cooperation Treaty applications and direct filings	69	53	48	60
	Patent families	686	679	675	658
	Granted	2,140	2,244	2,233	2,199
	Live cases	3,876	4,065	3,997	3,754
Trademarks	Australian	264	273	271	266
	Overseas	45	52	49	46
Plant breeder's rights	Australian	57	59	59	65
	Overseas	25	20	23	22
Registered designs	Australian	2	2	3	14
	Overseas	3	5	6	17

Space start-up Quasar takes off with CSIRO technology

Over the next decade, tens of thousands of satellites will be launched to support a surge in demand for space-derived data, from monitoring events such as bushfires and floods to connecting sensors on 'Internet of Things' networks.

Present-day ground stations are dishes that talk to one satellite at a time. In future, heavy data congestion is expected to limit the potential of satellites and the downstream industries they support.

While it would be possible to build more ground stations, our phased array technology provides an efficient and flexible solution to the congestion challenge.

Originally developed for radio telescopes like our Australian Square Kilometre Array Pathfinder telescope in Western Australia, the highly sensitive multibeam systems provide a wide-angle view of the sky.

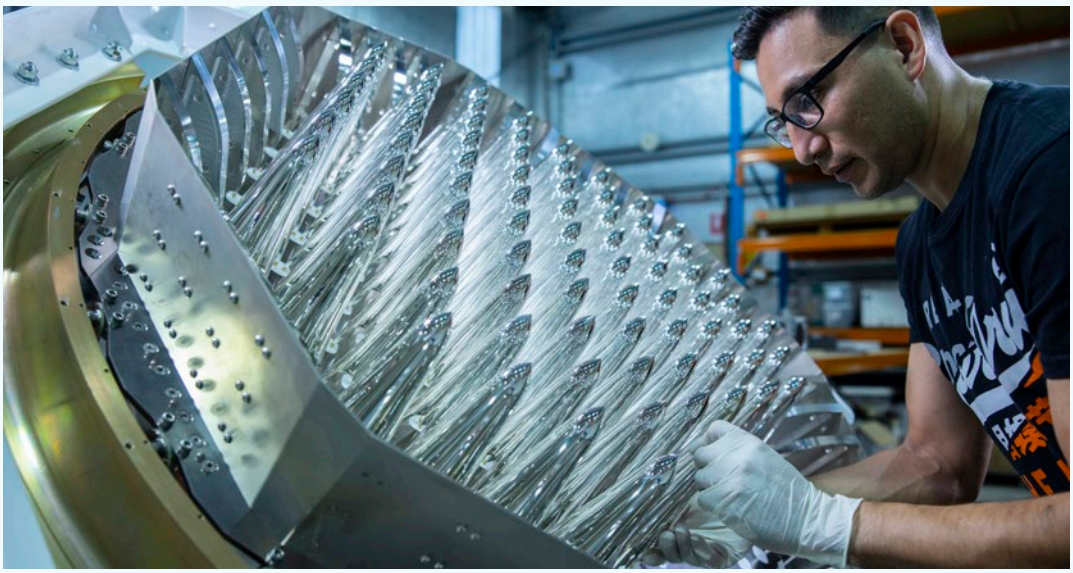
Taking the technology off the telescope and adapting it for space communications, space start-up Quasar Satellite Technologies will develop ground stations capable of communicating with hundreds of satellites simultaneously.

Quasar is backed by $12 million in funding, technology and industry expertise from CSIRO, the CSIRO Innovation Fund, managed by Main Sequence, the Office of the New South Wales Chief Scientist and Engineer, and Australian companies Vocus, Saber Astronautics, Fleet Space Technologies and Clearbox Systems.

The new company will capitalise on the US$130 billion satellite ground communications market, offering the technology 'as a service', enabling commercial and public sector partners to access data from satellites in low, medium and geostationary orbit from anywhere in the world, similar to how cloud computing services work today.

Quasar is building the technology using an Australian-based team with expertise and research support from us.

This will not only ease the forecast congestion challenge but also be a fantastic example of technology translation from basic research to industry.



The latest evolution of our phased array technology will help Quasar's ground station service to communicate with hundreds of satellites simultaneously.

My Bestie Kitchen founder, Amanda Falconer, who worked with our researchers to develop natural medical gummy chews for pets. Amanda participated in our SME Connect Innovate to Grow program and received funding from CSIRO Kick-Start. Read more about our work with SMEs on page 92.

Growing companies for impact

We partner with companies of all sizes to take our world-class technologies to market and deliver positive outcomes for Australia.

In addition to the established model of licencing our technology, we may also take an ownership stake in companies that utilise our IP and research and development capabilities where there is a strong business case and a compelling reason to do so.

Commercialisation support

There are multiple pathways we may take when we acquire an equity position in a company. We spin out new high-technology small- to medium-sized enterprises (SMEs), where we recognise the value of a technology and bring together commercialisation resources, management teams and investors to create and support entirely new companies that create new jobs and value for industry.

We also make our IP and research and development capabilities available to early-stage companies with limited resources. In these situations, we assign our IP to the new company in exchange for an ownership stake or take shares in a company as payment for our research and development services. These arrangements can help a start-up company preserve their cash resources, which increases the likelihood that the company will successfully reach its goals and objectives.

Capital investment

In the past 12 months, our portfolio companies have reached key research and development milestones, progressed new technologies to market and attracted significant new capital investment. Our commercialisation activities in this period have included the creation of 6 new SMEs where we have taken a founding equity position.

At the end of June, we held investments in 5 active listed companies, 39 unlisted companies and 3 early-stage investment funds (including the CSIRO Innovation Fund managed by Main Sequence). The combined value of these holdings is shown in Note 2.1C of our audited financial statements in Part 5.

Marine monitoring for offshore carbon capture and storage

Carbon capture and storage (CCS) is part of the suite of technologies that will contribute to lowering atmospheric emissions of carbon dioxide (CO_2) from Australia's energy and emission-intensive industrial sectors. Capturing emissions is one component on the solution and the other lies in the secure storage of carbon, sequestered in stable geological sites.

Drawing upon the breadth of our CCS expertise across multiple disciplines, we successfully tested and validated technologies and methods that could be adopted to monitor coastal environments where CO_2 geological storage sites may be located.

Through Commonwealth Education Investment Funding for capital equipment, and subsequent co-funding between CSIRO and the Carbon Dioxide Collaborative Research Centre (CO2 CRC) and the Australian National Low Emissions Coal Research & Development, we built and tested marine environmental monitoring and verification technologies for carbon storage projects. These technologies were specifically designed for use in the challenging and dynamic shallow waters of the coastal Gippsland region but could also be deployed in future carbon storage projects around Australia and globally.

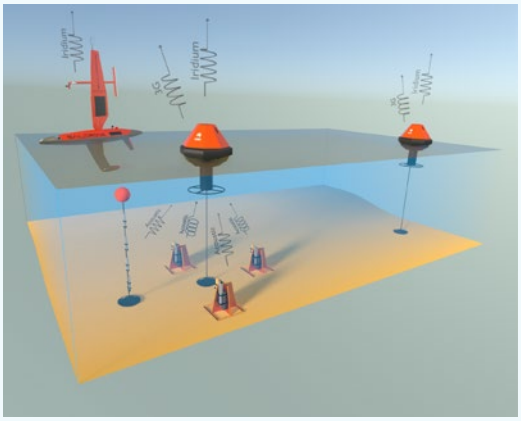
The technologies included moorings and seabed frames (termed landers) fitted with an array of sensors to measure parameters such as pCO_2, pH, oxygen, methane, temperature and salinity. Passive acoustic sensors and underwater sonar systems (echosounders) were also used to provide information about biological communities in the water column and have the additional capability of detecting gas bubbles.

In addition to these static platforms, repeat marine surveys characterised the marine environment through acoustic methods using multibeam echo sounder, a sub bottom profiler and diver surveys that collected sediment and biological samples from the study area. This information was augmented by further surveys using autonomous surface vehicles (Saildrones) equipped with numerous sensors for monitoring CCS.

From this work we have developed and validated:

- modelling tools for use in designing CCS-related marine environmental monitoring plans
- a state-of-the-art networked monitoring technology toolkit that has been field tested and optimised for offshore CCS environmental assurance monitoring
- a database of environmental signals for reference use in future monitoring
- assessment of novel, rapid-assessment tools for biological indicators of environmental impact, based on (e)DNA approaches.

This project is another exemplar of our unrivalled capability in carbon capture and subsurface storage research in response to the national challenge of emissions reduction. Not only does this work advance Australia's CCS capability to mitigate atmospheric CO_2 but also contributes to international knowledge, informing best practice for monitoring CCS in shallow marine environments globally.



We tested and validated a suite of technologies for monitoring CCS impacts in offshore coastal waters.

Ceres Tag – better management of livestock through data

Australia's $17 billion livestock industry plays a vital role in the national economy, fuelled by population growth and increasing demand for high-quality Australian exports, particularly in Asian markets.

However, resource scarcity and increasing costs are placing pressure on livestock producers to deliver more from less. Locating livestock and monitoring their activity can be a time-consuming and often costly challenge for many producers.

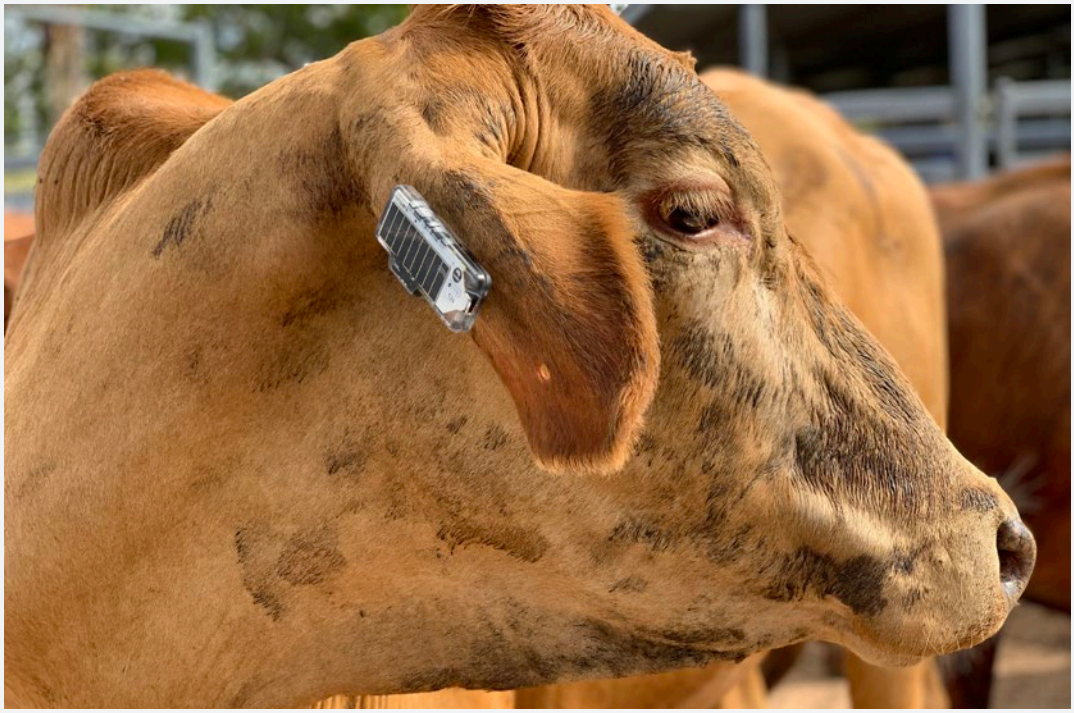
To tackle this problem, we partnered with Ceres Tag to develop a livestock information platform and smart ear tag for tracking and monitoring livestock. The collaboration combines deep technology expertise with years of research and knowledge in livestock production.

Ceres Tag provides animal location and activity data to improve management of both livestock and the paddock. The aim is to enable producers to use data to reduce operating costs and increase operational efficiency while maintaining the welfare, health and performance metrics of their livestock.

The tag features geo-location for greater livestock traceability and improved provenance information. It gives producers greater control over grazing management, allowing them to locate livestock remotely and to be alerted to animals wandering off the property, stock theft and significant changes to their daily activity. This data assists in times of crisis, such as floods and bushfires when animals are potentially threatened. Knowing where they are is vital in case they need to be moved to a safer place.

Ceres Tag links animals directly to satellites and does not require on-farm towers or cellular network coverage. The tags also use battery chemistry and solar energy harvesting, allowing the devices to last the lifetime of the animal (up to 10 years). This commercial application allows direct transfer of data from livestock to satellite.

Ceres Tag is undergoing large-scale trials throughout Australia and internationally to test and validate the operational proficiency of its complete livestock information platform.



We worked with agtech company, Ceres Tag, to develop next-generation ear tags to track and monitor livestock, unlocking invaluable data for the livestock industry.

Establishing collaborations and multidisciplinary research partnerships

University research collaboration

Our focus on fewer bigger portfolios of work means we need to also focus our attention on how we partner more effectively with universities and others, to help us deliver impact at increasing scale and complexity.

These examples illustrate some of the new ways we are working with universities through strategic university partnerships, expanding what we do with long-term strategic university partners and under our Missions program, and developing new multi-stakeholder partnerships to build new industries with a university as a key partner.

The Resilience Initiative for Food and Agriculture

Last year, we developed a new program of work with the Australian National University (ANU) and the Department of Foreign Affairs (DFAT) – the Resilience Initiative for Food and Agriculture (RIFA). This initiative builds on previous smaller-scale collaborations and gained rapid momentum and visibility under the new strategic partnership we established with ANU.

RIFA was formed as a mechanism for DFAT to achieve a more coordinated and agile response to the recent multiple shocks to the Asia and Pacific region's food systems, including from COVID-19, emerging pests and diseases, climate change and extreme weather events. The initiative leverages our globally recognised and complementary strengths to deliver solutions for pressing agriculture and food security needs in this region. In these partnerships, we've built trust and established resources to navigate the opportunities and challenges together. In less than 12 months, RIFA has provided technical and advisory services to industries and governments in the region and employed a CSIRO Early Research Career (CERC) postdoctoral fellow.

Victorian Hydrogen Hub

We received $10 million in funding from the Victorian Government, which enabled our Hydrogen Mission researchers to partner with Swinburne University of Technology (SUT) to jointly establish the Victorian Hydrogen Hub. Read more about our Hydrogen mission on page 21 and our collaboration with government on page 41. The hub will bring researchers, industry partners and businesses together to test, trial and demonstrate new and emerging hydrogen technologies. As part of this initiative, we will use $1 million of this funding to develop a refuelling station at our Clayton site to fuel and test hydrogen vehicles. This partnership with SUT includes a co-designed Higher Degree Research program for jointly supervised postgraduate students to help build the future capability for industry innovation. The first cohort is being recruited now to start in 2022. A core element of the program will promote STEM equity by allocating 50 per cent of the program scholarships to women to increase their participation in this new industry.

Resilience to Emerging Infectious Diseases in northern Australia

As part of a long-standing trusted strategic relationship with James Cook University, we are expanding the scope of our partnership to work on large regional challenges. In mid-2020, we jointly established the Resilience to Emerging Infectious Diseases (REID) program to address the significant biosecurity risks in northern Australia. This program will collaboratively build a more integrated operational response capacity for emerging infectious diseases in northern Australia.

It will leverage our complementary research strengths, our collective PC3/PC4 laboratory infrastructure and our growing multi-stakeholder collaborative research programs into emerging infectious diseases to support the nation's biosecurity and one health needs.

Ten new collaborative projects, including COVID-19 work, for government and industry are underway or in development across Australia and the Indo-Pacific. Two projects have been completed, including a new summer school for the mathematical modelling of infectious diseases for honours students.

Table 3.3 shows the number of jointly supervised higher education research students (12 months to 31 May 2021 excluding vacation students) and joint authorship papers for the universities we most actively collaborate with. The table also illustrates the universities we have collaborated with to produce the highest number of joint papers.

Over the past 5 years, 67 per cent of our publications were co-authored with domestic collaborators, including all research-active Australian universities, and 64 per cent included international co-authors. Our collaborations with the Universities of Queensland, Western Australia and Tasmania were extensive in the research fields of Plant and Animal Science, Agricultural Science and Environment/Ecology. Read more about these key areas of our science on page 43. We have strong collaborations with Monash University, the University of Melbourne and RMIT University in Chemistry and Materials Science.

We have long-term partnerships with Victorian universities with a strategic focus on working together to support the Victorian manufacturing sector. In Space Science, we collaborate with Curtin University, the University of Sydney and the University of Western Australia.

To complement our researcher collaboration, we contribute to training and developing Australia's research workforce by co-supervising more than 1,450 undergraduate and postgraduate university students each year. Some of our major collaborators in co-supervision include the Australian National University, Monash University, the University of New South Wales and the University of Tasmania. Read more about our role and programs on page 87.

Additionally, 11 of our sites are co-located with universities. At these sites we often fund and develop shared research infrastructure and equipment.

Table 3.3: Highlighting our most active university collaborations

UNIVERSITY	NUMBER OF COLLABORATIVE PUBLICATIONS	CO-SUPERVISED STUDENTS	AGRICULTURAL SCIENCES	CHEMISTRY	ENGINEERING	ENVIRONMENT AND ENERGY	GEOSCIENCES	MATERIAL SCIENCE	PLANT AND ANIMAL SCIENCES	SPACE
University of Queensland	1,310	109	103	57	34	306	65	35	267	11
University of Western Australia	1,173	36	83	25	51	220	152	14	182	169
University of Melbourne	1,165	39	97	93	46	159	100	78	99	63
Monash University	1,125	102	21	216	59	80	106	250	22	28
Australian National University	1,101	139	34	25	109	189	88	21	199	140
University of Tasmania	1,025	66	53	8	15	240	187	1	303	71
University of New South Wales	858	106	26	54	94	98	161	45	53	40
University of Sydney	816	52	43	50	62	73	21	23	78	204
Curtin University	731	33	12	25	60	44	166	5	44	247
University of Adelaide	629	41	126	26	16	124	59	24	82	17

G-PST Consortium

This year, with the Australian Energy Market Operator, we joined the Global Power System Transformation (G-PST) Consortium. This is a global research partnership focused on accelerating the decarbonisation of our electricity system. Led by Chief Executive Officers of 5 of the world's leading system operators from areas with very high renewable energy systems, this group is partnering with more than 25 prominent system operators from Africa, Asia, Latin America, Eastern Europe and other regions.

Around the world, countries are transitioning to low emissions energy futures. The energy sector accounts for 54 per cent of Australia's emissions. It is central to our net zero future. The cost of renewable energy is no longer our major challenge. Instead, the focus is on integrating this energy into our electricity systems.

Science is key to the consortium's work. The electricity system operators will work with leading international researchers to accelerate the transition to low emission, low cost, secure and reliable power systems.

In April, we welcomed the University of Melbourne, RMIT University, Monash University, University of New South Wales, Electric Power Research Institute and global consultancies, Strategen, GHD and Aurecon to that partnership to form an Australian consortium. Together with our partners, we will focus on quantifying the technical requirements of future power systems to operate reliably and at least cost, understanding the opportunities associated with Australia's world-leading levels of rooftop solar.

We will also develop research plans focused on inverter design, power system stability tools and methods, restoring electricity systems with 100 per cent renewable energy, and developing a research plan for control room systems for the Australian Energy Market Operator and other grid and market operators.

By working closely with system operators and leading researchers internationally and focusing on the key challenges of decarbonising our electricity sector, the G-PST will accelerate the clean energy transition.

We joined the Global Power System Transformation Consortium to help accelerate the transition to low emission, low cost, secure and reliable power systems.

Bait efficacy study stops mice in their tracks

This year, farmers experienced possibly the worst mouse plague on record. While landowners in northern New South Wales and southern Queensland battled the brunt of the outbreak, mouse numbers across the country rose steadily.

A few years earlier, our scientists received reports from farmers of what appeared to be reduced effectiveness of Zinc Phosphide (ZnP) coated wheat bait, the only in-crop rodenticide for the management of mouse damage in broad-scale agriculture in Australia, registered about 20 years ago.

In addition to reduced ZnP effectiveness, farming practices had changed over the 20 years since the compound was registered. The adoption of environmentally sustainable cropping practices, such as minimum or no-tillage systems, resulted in a significant increase in available shelter and alternative food sources for mice.

Concerns expressed by grain producers prompted the Grains Research and Development Corporation (GDRC) to commission research into the efficacy of ZnP bait. Our research was the first laboratory-based wild house mouse bait efficacy study done in Australia since ZnP was registered for agricultural use.

These studies focused on the sensitivity of mice to ZnP. The results showed that the current mixing rate of 25 grams per kilogram was lethal in only about 50 per cent of laboratory mice and to achieve a mortality rate of greater that 80 per cent, the dose of ZnP needed to be doubled to 50 grams per kilogram.

The study further showed that if mice did not eat a lethal dose from one grain of bait, they developed an aversion to the bait and refused to consume any more toxic grain, showing the importance of ensuring every grain of bait was a lethal dose.

Ongoing concerns and conversations continued as increased mouse numbers moved to plague proportions. The huge mouse numbers caused significant social, economic and environmental damage to farming communities with grain growers losing millions of dollars as well as crop losses.

Mouse researchers, Steve Henry and Nikki Van de Weyer, processing a captured mouse in the field. Credit: Sharyn Watt.

With the results of this study, industry body Grain Producers Australia (GPA) applied to the Australian Pesticides and Veterinary Medicines Authority (APVMA) for an emergency use permit to increase the ZnP in mouse baits.

In May, the APVMA approved the emergency permit to increase ZnP to 50 grams per kilogram of mouse bait – a move that was well-received by industry and grain growers in eastern Australia.

This was a collaborative effort with GRDC and GPA and provided relief to farmers ahead of the 2021 winter crop planting. Read more about our Rural Research and Development Corporations on page 62.

Following the approval of the emergency permit, together with GRDC, we evaluated 50 grams per kilogram of ZnP in field conditions.

This research project is part of a larger suite of investments that we are leading, supported by GRDC, to improve mouse management for Australian grain growers.

Characterising the stygofauna of the Beetaloo Sub-basin

Together with researchers from Charles Darwin University (CDU), we used fishing rods and handlines to plumb the depths of underground aquifers in the Northern Territory, revealing a diverse variety of tiny aquatic animals known as stygofauna, mostly between 0.3 and 10 millimetres in length.

The largest animal found – a shrimp called *Parisia unguis* – measured up to 20 millimetres and is likely the apex predator in these communities. The presence of a predator indicates a complex food chain within the Beetaloo stygofaunal communities.

The Beetaloo animals are different from stygofauna recorded from more extensively studied Western Australian aquifers, with new genera and species of crustaceans likely to be present in the Beetaloo.

This study provides the first description of stygofauna in an otherwise little-studied region of Australia and likely includes discovery of new genera and species of crustaceans.

The presence of the same stygofaunal species at widely separated sites across the Cambrian Limestone Aquifer could indicate high connectivity within the aquifer, which would need to be considered in light of shale gas development proposals.

Nightmare in the dark: The blind shrimp *Parisia unguis* is the apex predator of the Beetaloo stygofauna.

The stygofauna research team in the field with extraction pump – (left to right) CSIRO's Dr Gavin Rees and Dr Daryl Nielsen, CDU's Professor Jenny Davis and Dr Stefanie Oberprieler.

Further work is underway through our Gas Industry Social and Environmental Research Alliance (GISERA) to quantify the risk of contamination impacts on stygofauna from possible industrial spill events that considers migration pathways and processes, including adsorption, dilution and microbial metabolism in soils and aquifers as well as the high connectivity in groundwater systems.

CDU Professor, Jenny Davis, said stygofauna were the ultimate climate change adapters, having moved underground as surface waters of ancient inland Australia dried out.

This research responds to recommendations from the Northern Territory Government's Scientific Inquiry into Hydraulic Fracturing in Northern Territory. This baseline data is essential for biodiversity conservation and the maintenance of the ecological integrity of high value groundwater-dependent ecosystems in the region. It also informs appropriate policy and management responses to shale gas development proposals.

Cooperative Research Centres

The Cooperative Research Centres (CRC) program supports collaborations between researchers, industry and the community to foster high-quality research and development. The program enables research teams to connect across institutions and industries to inform research priorities and take up research outputs to maximise impact.

CRC grants provide successful applicants with access to grant funds for up to 10 years. Since the CRC program commenced, the Australian Government has funded 230 CRCs; 26 were active in 2020–21 and we participated in 13 of these.

We are the single biggest research organisation involved in CRCs and have contributed to more than 154 CRCs over time. When CRC research results in commercialisation, a separate legal entity is established and our share of the new entity is treated as a subsidiary, joint venture or associate.

CRC Projects

We also participated in 19 CRC Projects, which are smaller collaborations with timelines of up to 3 years and grants of up to $3 million. CRC Projects develop important new technologies, products and services that deliver tangible outcomes. This year, our total cash and in-kind (for example, staff and use of assets) contribution to CRCs and CRC Projects was $11.8 million.

In May, we hosted an event with the Future Battery Industries CRC at the Perth Convention Centre to preview the Accenture report *Future Charge – Building Australia's Battery Industries* and to launch our Critical Energy Minerals Roadmap report.

Table 3.4: Cooperative Research Centres we participated in

CRC	SCHEDULED END DATE
CO2 CRC	11 Dec 2020
Autism CRC	30 Jun 2021
Bushfire and Natural Hazards CRC	30 Jun 2021
Optimising Resource Extraction	30 Jun 2021
Innovative Manufacturing CRC	30 Jun 2022
CRC for Developing Northern Australia: Establishing eye screening services	31 Aug 2022
Cyber Security CRC	1 Dec 2024
Future Battery Industries CRC	30 Jun 2025
SmartSat CRC	30 Jun 2026
MinEx CRC	30 Jun 2028
Blue Economy CRC	30 Jun 2029
Reliable Affordable Clean Energy (RACE) for 2030 CRC	30 Jun 2030
CRC for Transformations in Mining Economies	30 Jun 2030

Table 3.5: Cooperative Research Centre Projects we participated in

CRC-P	SCHEDULED END DATE
Ended 2020–21	
Developing Northern Australia: New pastures to increase livestock productivity across the north	30 Sep 2020
Developing Northern Australia: Developing sustainable cropping systems for cotton, grains and fodder	1 Oct 2020
CRC-P Kapunda In-Situ Copper and Gold Field Recovery Trial	31 Dec 2020
CRC-P Long-life alloy components for efficient hydrometallurgical processing	31 Dec 2020
CRC-P Implementing intelligent automated reporting in radiology practice	30 Jun 2021
CRC-P Optimal scheduling of air conditioning systems with renewable energy and thermal storage	30 Jun 2021
Ending 2021–23	
CRC-P Transforming joint surgery rehabilitation with artificial intelligence in telehealth	19 Jul 2021
CRC-P A novel process for producing battery grade nickel and cobalt sulphates	30 Sep 2021
CRC-P Automating data collection and analytics in underground mines using drones and AI	31 Dec 2021
CRC-P Development of a new commercial-scale process for producing high purity graphite (>99.95%)	31 Dec 2021
CRC-P Smart tools for agronomic crop insights using Machine learning (ML) and Artificial Intelligence (AI)	1 Jan 2022
CRC-P Smart Sensor and Deep Learning Behavioural Engine for Personalised Health Monitoring	31 Mar 2022
CRC-P Privacy-Preserving Analytics for the Education Technology Industry	14 Aug 2022
CRC-P Using AI and a hybrid ESS solution to fully integrate solar generation into the distribution system	31 Aug 2022
CRC-P Future-proofing the salmon farming industry in the face of climate warming	31 Mar 2023

This year, we became a member of the CRC for Transformations in Mining Economies. This national initiative has brought together over 70 leading mining and mining service companies, regional development organisations, state and Commonwealth governments, and research partners to address the complex challenges underpinning mine closures and relinquishments.

We also participated in the Reliable Affordable Clean Energy for 2030 CRC. This is an industry-led research effort to drive energy innovation across the supply chain to deliver better value for energy customers. It is using cutting-edge research and developing new technology to boost Australian business energy productivity, integrate distributed energy resources into the grid, reduce energy bills for consumers, enhance energy reliability and cut carbon emissions.

In June, the successful outcomes of Round 22 were announced, which will see us participate in 3 additional CRCs.

The Marine Bioproducts CRC will address the increasing global demand for agricultural products as food and feed and for industrial purposes, which is estimated to grow by 15 per cent over the coming decade.

The Heavy Industry Low-carbon Transition CRC will enable our heavy industry sector to compete in the low-carbon global economy for carbon-neutral materials, such as 'green' iron, alumina, cement and other processed minerals.

The Digital Finance CRC brings together a unique group of stakeholders in fintech, industry, research and regulation to develop and commercially exploit the huge opportunities arising from the next transformation of the financial markets.

Innovative Manufacturing CRC collaboration to develop a Battery Management System for Australian conditions

This year, we collaborated with the Innovative Manufacturing CRC, an independent and for impact cooperative research centre that helps Australian companies address industry challenges and develop solutions that lead to commercial outcomes through research-led innovation in manufacturing products, processes and services.

We partnered with Energy Renaissance, Australia's first lithium-ion battery manufacturer in New South Wales, to develop a Battery Management System that can work across Energy Renaissance's suite of superStorage™ products. We brought our deep expertise in battery chemistry to the design and build of the technology, as well as our work in automotive, rail and energy storage domains.

The system is a critical component of today's batteries. It controls the charging protocols of a battery and manages its operation in real-time, determining the state of charge at any given time and providing information on the state of health (how long until the end of life). As more batteries are deployed on the grid, in businesses and homes, the project is also addressing cyber security risks.

The technology provides robust and secure communication with batteries for real-time monitoring and optimising performance for Australian conditions. The technology will be in all Energy Renaissance's products from late 2021.

CSIRO principal research scientist Adam Best, Senator Hollie Hughes, Energy Renaissance director of development and technology Brian Craighead, Energy Renaissance managing director Mark Chilcote, Prime Minister Scott Morrison, former Minister for Industry, Science and Technology Karen Andrews and Innovative Manufacturing Cooperative Research Centre managing director David Chuter at the launch of the Resource Technology and Critical Minerals Processing roadmap. Credit: Energy Renaissance.

Rural Research and Development Corporations

Australia's Rural Research and Development Corporations (RDCs) help drive agricultural innovation. They encourage Australian government and primary producers to co-invest in research and development to benefit industry and regional communities. There are currently 15 RDCs.

During 2020–21, we engaged with 15 RDCs in new and ongoing commercial research and development contracts valued at $341.7 million. We earned $35.6 million in earnings for our work this year with RDCs and executed 35 new contracts with 8 RDCs worth $34.1 million in total.

We have key partnerships in excess of $10 million with 8 RDCs, including the Grains Research and Development Corporation (GRDC), Meat & Livestock Australia, Wine Australia and Cotton RDC.

Since the mid-2000s, we have had productive partnerships with RDCs, which have delivered significant innovation in mixed farming enterprises. For example, the research and development of dual-purpose canola, funded by the GRDC and Meat and Livestock Australia, has become an integral and highly profitable component of mixed farming systems in southern Australia.

Farming systems research

Dual purpose canola – canola grazed by livestock and harvested for grain – increases profitability for individual paddocks because livestock can be grazed at no cost to grain production, or graze-grain income exceeds grain-only crops. It also underpins weed and disease control in dual-purpose cereal crops and in perennial pastures. An economic analysis of dual-purpose cropping indicated that businesses could generate $100–200 per hectare due to grain income and increased autumn and winter grazing while pastures are rested.

In 2021, to date we have seen the largest dual-purpose canola plant, with at least 150,000 hectares, planted in southern New South Wales. Mayfield, a mixed farming enterprise near Oberon in New South Wales, experienced a world-record canola yield of 7.16 tonnes per hectare. Mayfield's manager said working with us for more than a decade, with support from our relationship with GRDC, made the achievement possible. Read more about our work with RDCs on pages 48 and 57.

Providing products and technical and advisory services

Advice for government

We provided data and information to government to inform evidence-based policy development and decision-making. This included briefings and reports on our research of interest to government and submissions to government consultations and parliamentary inquiries.

We conducted a survey of Australians' attitudes to the emerging field of synthetic biology, which was an important first step to assess public attitudes to then inform the design and delivery of our future research.

Our circular economy roadmap was commissioned by DISER and developed in collaboration with 83 industry, research and government partners. Read more about the roadmap on page 23.
We partnered with the Australian Energy Market Operator and industry stakeholders to produce the GenCost report, a yearly updated estimate of the cost to generate electricity for new power plants in Australia. We delivered the *State of the Climate 2020* with the Bureau of Meteorology, which shows continued warming and an increase in extreme weather events. This biennial report provides a scientific foundation for economic, environmental and social decision-making.

We released a report on Australia's biosecurity future with Animal Health Australia, Plant Health Australia and the Centre for Invasive Species Solutions. The report found Australia is at risk of increased disease outbreaks and pest incursions, weakened exports and damage to our global trading reputation.

Assist government decision-making

Our research tools such as modelling and data analysis are valued by government to assist and inform policymakers and the community.

We assessed the impact of Australia's 2019–20 Black Summer bushfires on plant species with the Centre for Australian National Biodiversity Research. Read more on page 111. We partnered with the University of Queensland to provide evidence that wastewater testing can detect COVID-19 in communities weeks before people display symptoms. Read more on pages 26 and 138.

Our technology was deployed by the Australian Border Force across the Torres Strait to combat illegal activity in the region such as foreign fishing.

Delivering government programs

We run programs on behalf of government, where the programs require our specialist expertise and connections.

In February, we hosted the inaugural India-Australia Circular Economy Hackathon in partnership with NITI Aayog. The concept of the hackathon originated last year at a virtual summit where the prime ministers of both countries committed to working together on circular economy innovation initiatives. Through the program, almost 80 teams of students and small- to medium-sized enterprises (SMEs) from India and Australia focused on the global challenge of minimising waste and creating sustainable business practices. Read more about our work with SMEs on page 92.

As part of the Federal Government's National Environmental Science Program, we will host the new Climate Systems Hub. The hub will advance our understanding of Australia's climate and its extremes, including the fundamental drivers of rainfall, drought and bushfires, and will inform climate adaptation solutions for Australia. We are also a partner in 3 other new hubs, which the Government announced in December.

We are managing a program where AI is assisting Vietnam with its economic recovery from COVID-19. The initiative is funded by the $11 million, 4-year flagship Aus4Innovation program that helps strengthen the Vietnamese innovation system and its economic and digital future. It is funded by DFAT in collaboration with the Ministry of Science and Technology of Vietnam. The initiative will provide short-term funding for innovative AI solutions to deal with the consequences of the pandemic. It will also provide longer-term technical support and training to help implement Vietnam's future AI strategy.

The Atlas of Living Australia has been leading the national citizen science coordination response to the 2020 summer bushfires, improving the public's ability to engage in citizen science projects. Read more about citizen science on page 19.

Almost 80 teams of students and SMEs from India and Australia focused on the global challenge of minimising waste and creating sustainable business practices.

Consumer Data Standards

As part of an effort to give consumers greater access to their data and more control over it, the Australian Government announced the Consumer Data Right (CDR) legislation in 2017. The CDR helps consumers to compare and switch between finance, utility and other services, and it encourages competition and innovation among service providers.

In 2018, we were appointed to perform the interim role of the Data Standards Body and played a key role in developing and delivering the CDR. We helped to develop common technical standards in data formats, security profiles, and consumer experiences and consent, consulted with stakeholders, and put relevant Australian Competition and Consumer Commission Rules into effect via the standards.

The standards make it easier and safer for consumers to access data that businesses hold about them and to share data securely with trusted, accredited third parties. It encourages competition between service providers leading to more innovative products, which is critical for COVID-19 recovery and business resilience.

As a society, we continue to experience high-profile data breaches. In 2020, more than 60 per cent of Australians were concerned with the privacy of their data.[1] Due to data being mishandled, businesses are also concerned with their brand reputation. To restore public confidence, secure, seamless and transparent data collection is vital.

In 2020, the CDR was launched in the banking sector as 'Open Banking'. Using secure and easy-to-use processes, it revolutionised the way consumers share their banking data, such as transaction history, interest rates and account balances, with prospective banks, brokers, FinTechs and other accredited businesses.

The CDR will be introduced in the energy and telecommunications sectors soon, before being rolled out across the entire economy, which will help consumers to better compare and access services that suit their needs.

In March, we completed our interim role and passed the responsibility to Treasury. We continue our work in data sharing, privacy, cyber security and responsibly using technologies and providing technical advice.

1 2020 Australian Community Attitudes to Privacy Survey.

Ultrafine+™ unlocking new mineral exploration targets

Sustainable global development relies on a new wave of mineral and metal supplies that can support the increasing demand for minerals required for emerging technologies, digitisation, and an energy transition to renewables and global electrification. Australia is mineral-rich, yet one challenge facing mineral explorers in discovering new deposits is the deep layer of surface cover, known as regolith. With about 80 per cent of the Australian continent covered by regolith, developing tools that can sense mineral deposits through the cover sediments could unlock many more resources for Australia.

While geochemical survey techniques have been widely used in the exploration industry for many years, our focus on ultrafine particles analysis is helping explorers detect very subtle signatures of buried ore deposits that are easily missed, generating new exploration targets.

Ultrafine+™ is our innovation that combines geochemical analysis of ultrafine particles (less than two-micron size) with mineralogical data plus landscape and terrane information. Next generation analytics powers the technology, which provides advanced interpretative support using big data sets and machine learning techniques combined with decades of regolith expertise.

This innovation produces better and more detailed maps, reducing the need for expensive and time-consuming drilling and increasing the speed to discovery, particularly in early-stage regional greenfield exploration.

Ultrafine+™ was commercialised by our partners at LabWest in Western Australia. Demand for the new exploration tool now accounts for around 80 per cent of the company's total business, making it their key service for the industry. In response to this demand, LabWest has increased its capacity in instrumentation, which in turn has led to a tripling of their workforce.

Integrating geochemical, mineralogical and spatial data with expert interpretation and decision-making support has created a major advantage over traditional survey approaches in the industry. Ultrafine+™ is helping mineral explorers generate exploration targets faster, widening mappable chemical footprints and probing beneath shallow in-situ and transported cover that hinders exploration through vast parts of the country. Using near surface geochemistry, this tool potentially doubles the effective search area for mineral deposits compared to historically used methods.

Our Ultrafine+™ innovation is helping explorers target new mineral deposits hidden beneath regolith cover.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.6):

1. The application of research benefits the Australian economy, society and environment.
2. The provision of timely advice, information, and specific solutions informs and protects society and the environment.
3. New knowledge and solutions are available to be used by academia, government and customers.
4. Strong relationships with universities and other research organisations enhance Australia's innovation capacity.
5. We are trusted as the national science agency and have a reputation for world-class pioneering research.

Table 3.6: Summary of our performance for conducting and facilitating the uptake of excellent scientific and technology solutions

PERFORMANCE MEASURES SOURCE: 2020–21 CORPORATE PLAN	TARGET	RESULT
Impact: value of benefits created for Australia		
Demonstrated value of benefits underpinned by an increasing annual portfolio of externally validated impact case studies capturing triple-bottom-line impacts	Evidence of maintained or increased impact	**Achieved**: completed 25 case studies
Customer satisfaction		
Customer Net Promoter Score (NPS) maintained with increased sample	NPS +40	**Achieved**: NPS +51
Research is recognised as excellent, referenced and used by academia		
Normalised Citation Impact (NCI) (excluding medical research)	NCI 1.5	**Not achieved**: NCI 1.49
Science and technology are adopted and create value for industry		
Mixed methods quantitative assessment of equity portfolio; 3-year rolling average of revenue from Intellectual Property (i.e. royalties, licensing); spin-out companies established and the creation of new SMEs facilitated	Maintain or increase performance across each method	**Achieved**: SMEs and other companies were created yielding substantial returns and gains in equity holdings from the commercialisation of CSIRO technology. Three-year average royalty proceeds were marginally lower.
Effective collaborative relationships with the research and development sector		
Demonstrated evidence of the value created from deep R&D collaborative relationships with mixed methods, including joint publication, formal partnerships and qualitative assessment	Evidence of the value created in a collaboration from a mixed methods assessment	**Achieved**: multi-agency partnerships established with RIFA, Victorian Hydrogen Hub and REID in Northern Australia that will deepen R&D collaborative relationships and contribute to regional and national benefits.
CSIRO is recognised as a trusted advisor		
Business Sentiment Survey: awareness of potential to work directly with CSIRO and knowledge of CSIRO	Increase year on year	**Partially achieved**: awareness of the potential to work directly with us remained stable at 35% and more than 54% had a significant or moderate knowledge of us, which is an improvement since the previous survey.

Impact: value of benefits created for Australia

During 2020–21, we completed 25 impact case studies, meeting our target across our portfolio. These represent the value delivered by our research activities and our ability to assess impact from our national facilities, collections and services programs.

Three examples of impact case studies completed during 2020–21 are provided below.

Phalaris

Phalaris (*Phalaris aquatica* L.) is a long-lived perennial grass exploited as a pasture species for beef and sheep grazing. Unimproved Phalaris has deficiencies, such as the tendency to shed seeds and low yields of harvestable seed. We identified a need for improved Phalaris varieties to overcome these characteristics and be more productive, persistent and hardy for the grazing industries of Australia.

Our Phalaris breeding program commenced in the late 1950s. Improved varieties were released that successfully extended the potential adaption zones of Phalaris and improved its seasonal growth, grazing tolerance, persistence, seed production and grazing productivity. This was achieved through the discovery and exploitation of new domestication, production and persistence traits. Our improved Phalaris varieties have been widely adopted across Australia. It is estimated that between 1990 and 2020, 4.4 million kilograms of certified CSIRO Phalaris seed has been sold, equating to approximately 1.48 million hectares.

The program has delivered significant economic benefits over many decades and is expected to deliver further benefits through mitigating farm enterprise risks and improving ground cover and deep drainage.

MS3

MS2A was a revered varnish that went out of production in 2014. To address the significant gap in the market, we collaborated with the National Gallery of Victoria and Melbourne-based specialist chemical manufacturer, Boron Molecular, to develop and produce MS3, a conservation grade varnish to preserve irreplaceable heritage assets.

The team leveraged interdisciplinary expertise in chemical synthesis and continuous flow chemistry to develop MS3, an improved higher-quality version of the original MS2A varnish. Superior processing has resulted in the resin having improved colour, chemical stability and greater consistency between batches, which ensures minimal discolouration or cracking over time.

The work also highlighted the benefits of a flow chemistry production process over traditionally dominated batch chemistry to improve the quality of product and economics of manufacturing operation to solve the greatest challenges and create future industries for Australia. Keeping the customer at the heart of innovation led the team to progress from proof of concept to market within only 3 years.

Marine National Facility

Australia has the world's third largest marine jurisdiction, and the ocean plays an integral role in Australia's climate, culture and economy. With its state-of-the-art research capabilities, freely available data, and outstanding crew, scientists, and technicians, the Marine National Facility (MNF) plays an important role in Australia's innovation system. Government agencies, offshore industries and the public rely on MNF and its Research Vessel *Investigator* for data and research insights to improve technology, practices and stewardship policies.

The MNF delivers scientific and research impact to Australia's innovation system by providing knowledge, data and insights about oceans, weather and climate, marine geology and marine ecosystems. MNF generates economic value by improving ecosystem services, sector growth in aquaculture and agricultural production, Great Southern Reef health, and protecting fishery and other marine resources.

It benefits society through improved weather forecasting for greater citizen safety and also provides training programs to prepare students for careers in research and industry.

Consolidated analysis

Every 2 years we commission an external assessment of the overall value we deliver to the nation. This draws on the impact case study findings. The most recent study concluded in June 2020 and estimated a 7.6:1 return on investment. The next return on investment assessment will be available in June 2022.

Customer satisfaction

Net Promoter Score (NPS) is a key performance metric of our performance analysis. It is a global, industry standard score and a measure of advocacy and loyalty. We have conducted the customer satisfaction survey since 2016 (excluding 2020), and each year we have improved our score. This year, we achieved our best result in all areas covered in the survey, including NPS, Action and Experience. We have experienced continued improvement in customer advocacy, with an NPS of +51, which is considered excellent by world standards. Despite the difficulties, our customers found that we showed support during COVID-19 and improved our service and delivery.

We measure 4 dimensions of customer satisfaction. Experience: measures perception of responsiveness, reliability, staff competence, empathy and quality. Satisfaction: measures overall satisfaction with price, quality and service. Commitment: captures emotional engagement of customers, specifically regarding trust and commitment. Retention: rates future behaviour in relation to purchasing again, increasing spending, buying additional services and likelihood to recommend CSIRO to others.

We continue to show strong results in all categories, including record highs across all aspects of responsiveness (81 per cent favourable, an increase from 77 per cent in 2019) and staff empathy (89 per cent favourable, an increase from 84 per cent in 2019), as well as the way customers are treated, respected and opinions valued.

Our customers commented that our service and science quality is consistently high. Some customers, however, still experience problems with contracts and legal processes and find that our scientists are increasingly over-committed. Our communication and responsiveness improved, especially throughout the difficult COVID-19 period.

Overall satisfaction with our price, quality and service, which results showed was 76 per cent favourable, has increased significantly over the last 4 surveys.

The results show that we have not improved in reliability over the past 3 years in: getting the job done on time, getting it right the first time, making up for mistakes and loss, and consistency of delivery. Most of this may be related to over-commitment or the unavailability of scientists – although COVID-19 was also a contributing factor.

We scored lower in value for money, although this improved compared to previous years, with fewer comments about our costs. In comparison, our customers who gave us favourable responses see us as innovative, collaborative, professional and in touch with the needs of industry.

Even though 78 per cent reported they are highly likely to remain with our organisation in the next 12 months, only 35–40 per cent said they would buy additional services or increase spending. There are ongoing opportunities for us to reach out to customers, promote our research and services, and build more strategic partnerships.

Research is recognised as excellent, referenced and used by academia

Our citation performance remained relatively stable with an NCI value (excluding medical) of 1.49, which was slightly below our target of 1.5. This result shows our science quality has been relatively stable and our NCI is 49 per cent higher than the global average based on our publications output from 2016–20.

The sensitivity of the metric means that a sustained upward trend would be required to represent an improvement. We ranked seventh this year against the 40 publication-active Australian universities, compared to eighth using the same metric last year.

The NCI (excluding medical research) metric was adopted as it is more reflective of our research and our relative performance compared to peers.

Science and technology are adopted and create value for industry

Over the past year, the strong performance of our commercialisation efforts has been driven by 2 key factors: the solid performance of our existing portfolio companies and the addition of new high-quality contracts that are expected to deliver beneficial results in the future.

In 2020–21, we received new equity allocations in 11 companies. Of these, 7 were newly created SME ventures, including FutureFeed, Quasar Satellite Technologies, Eden Brew and Red Belly Blockchain. Read more about FutureFeed on page 48, Eden Brew on page 49 and Quasar Satellite Technologies on page 50.

Our existing portfolio companies also achieved excellent results this year; many made positive strides in creating value from our research outputs and support. Over the past 3 years, our portfolio companies have raised $450 million in capital. A share of this growth is attributed to CSIRO, recognised as $64 million of realised and unrealised returns to CSIRO in 2020–21.

While gains arise from increases in equity holdings, average return for royalties and licensing revenues over the past 3 years was $34.5 million per year, which is marginally lower than the $35.9 million average for the 3 years to 2020. This was driven predominantly by a recovery in cotton royalties, but as with the equity portfolio, we added high-potential new licences with NextOre, IDE Group and others.

Effective collaborative relationships with the research and development sector

Under our Missions program, we expanded our work with our long-term strategic partners and developed new multi-stakeholder industry partnerships with the university as a key partner.

The RIFA initiative leverages our globally recognised strengths in complex system science, bringing multiple disciplines together to deliver solutions for pressing agriculture and food security needs in this region. RIFA provided an opportunity to work with an independent partnership broker and to build trust to navigate the opportunities and challenges that come from working across 3 different organisations. In less than 12 months, RIFA established formal agreements, undertook a partnership process that established how we work, and established the pathway to enable us and future partners to deliver development-ready innovations.

We enhanced our strategic relationship with James Cook University to work on large regional challenges. The REID program is building a more integrated operational response capacity for emerging infectious diseases in northern Australia. This aligns with the work of ACDP, as well as our Infectious Disease Resiliences and Antimicrobial Resistance missions. Scientific positions are in place, which will support the research program to focus on modelling, bioinformatics, e-health and building digital decision platforms. These examples demonstrate our work to deepen R&D collaborative relationships and contribute to regional and national benefits.

To complement our researcher collaboration, we train and develop Australia's research workforce by co-supervising more than 1,450 undergraduate and postgraduate university students each year. Some of our major co-supervision collaborators include the Australian National University, Monash University, the University of New South Wales and the University of Tasmania.

CSIRO is recognised as a trusted advisor

We recognise the importance of being a trusted advisor to Australian industry and governments on behalf of society, providing solutions and advice based on our scientific research. We conduct an annual survey to determine the industry views and as an indicator of achieving this trusted advisor status.

This year we conducted a Business Sentiment Survey (after not completing one last year due to the impact of COVID-19 on Australian businesses). The awareness of the potential to work directly with us remained stable at 35 per cent. Among those who were aware of our work, there has been an upward trend since 2015; more than 54 per cent of respondents in the latest survey have a significant or moderate knowledge of CSIRO. The results of the community survey showed that trust remained relatively stable since last year with a total trust score of moderately and extremely trustworthy at 80 per cent.

1.2: Connect to global science, technology and innovation to access new opportunities for Australian innovation

Our key activities helped us achieve our strategic direction and aspirations:

- Actively contributing to the international priorities of Team Australia
- Developing strategic partnerships with leading international science institutions
- Attracting global investment to Australian science, technology and innovation
- Connecting Australian innovation to global markets.

We delivered on this requirement by:

- providing our support to Team Australia's *Partnerships for Recovery – Australia's COVID-19 Development Response* plan
- focusing our international engagement, operations and collaboration where there is a higher potential impact value return to Australia than available domestically
- prioritising key regions for sustained presence and development where there is clear intersection with our impact objectives and sustainable opportunities for Australian innovation.

Providing our support to Team Australia's Partnerships for Recovery – Australia's COVID-19 Development Response plan

An important part of our Global Strategy is to support the Team Australia program. Together with DFAT, the Australian Trade and Investment Commission (Austrade) and DISER, we work to build a stronger nation that protects Australia's international interests and contributes to global stability and economic growth. Our work this year shows that science and technology can be developed and delivered across borders, despite travel restrictions.

Over the last 12 months, we offered our scientific and technical capabilities to our network of regional partners to help shape Australia's Indo-Pacific COVID-19 response and recovery.

In Indonesia, we developed a Big Data Analytics program to support vaccine development decision-making. We also worked on modelling the resilience of regional food systems as part of the Resilience Initiative for Food and Agriculture. Read more on page 54.

The Australian Centre for Disease Preparedness continued its work across Southeast Asia to support the Association of Southeast Asian Nations (ASEAN) Centre for Public Health Emergencies and Emerging Diseases to prepare for future pandemics. Read more on page 98.

In partnership with the Australian Department of Defence, we studied the survivability of the SARS-CoV-2 virus. We collaborated with 5 Research and Development Council representatives from the United Kingdom, the United States of America, Canada, New Zealand and Australia. Read more on page 27.

We worked closely within international consortia, The Biosafety Level 4 Zoonotic Laboratory Network and the European Virus Archive – GLOBAL, and shared information on best practice and reagents and materials, including SARS CoV-2 viruses. This ensured we did not compete or duplicate our research and development efforts.

A partnership was established between us and the Peter Doherty Institute to test candidate antiviral compounds from international manufacturers. We also represented Australia at a World Health Organization meeting about COVID-19.

We contributed to meetings of the Brussels-based European Association of Research and Technology Organisations COVID-19 Working Group and were one of the only members from the southern hemisphere.

In partnership with the Department of Health and DFAT, we delivered a webinar on Australia's COVID-19 response and research to over 70 foreign embassies and high commissions.

Australian innovation speaks same health language around the world

Recording and sharing health information has been a long-standing challenge in many countries. Healthcare organisations often use different software and terminologies to record and share data. What one doctor records in their system as a chest infection might be recorded as an upper-respiratory infection in another, so the 2 systems might not be able to understand each other.

This is often resolved by using standard clinical terminologies, such as 'SNOMED Clinical Terms' or 'SNOMED CT', which matches common variations to help software talk to each other. However, using the clinical terminologies can be challenging for software developers to adopt, which means systems don't always receive the latest terminology updates. This becomes particularly problematic when new terms like COVID-19 are added to the list.

To help solve this challenge, our team developed Ontoserver, a software tool to help healthcare systems speak the same language. Ontoserver makes it easier for software to use SNOMED CT and other clinical dictionary-like tools, which results in better reporting for healthcare workers and ultimately better results for patients.

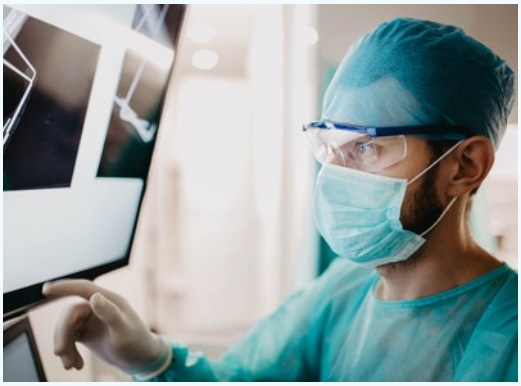
Ontoserver forms the foundation of Australia's national clinical terminology platform and has successfully underpinned the Australian Government's National Clinical Terminology Service since 2016. It enables more than 1,400 users and 70 licence holders in Australia to implement nationally endorsed code systems, which allows information such as a patient's allergies or medicines to be seamlessly exchanged between systems.

Our innovation has now been exported globally. With DXC Technology, we won the National Health Service's competitive digital tender with Deladus. As a result, Ontoserver went live in June for the National Health Service Digital Terminology Server in the United Kingdom and Ireland for healthcare organisations.

We have also established projects in New Zealand, the United States, Germany, Switzerland, Wales and the Netherlands in government agencies, software vendors and clinical colleges holding licences with healthcare organisations.

A shared health language is fundamental to healthcare innovation around the world. Ontoserver has the capability to enable data from disparate systems to be safely and meaningfully exchanged between care providers, researchers and service planners.

The local and global uptake on Ontoserver has a positive impact on Australian industry and is contributing to the strength of our intellectual property commercialisation revenue stream.



Ontoserver exchanges data safely between care providers, researchers and service planners.

Focusing our international engagement, operations and collaboration where there is a higher potential impact value return to Australia than available domestically

Many of today's challenges, such as climate change, health security and access to sustainable energy resources, are complex, interconnected and global. Our scientists have been successfully collaborating across the globe for over 100 years to solve these challenges facing people, the environment and society.

Our Global Strategy prioritises our international engagement, operations and collaborations to support our science partnerships, missions and business units. Our international work ranges from fundamental research to high-value strategic partnerships. These partnerships provide access to leading-edge scientific capability and capacity to support delivery offshore, and to advanced infrastructure and leveraged investments, which allows us to capture the greatest value from our innovations.

Our international engagements increase the profile of Australian science, technology and innovation. They promote Australian science and technology investment to a network of corporate and institutional investors. Often this funding is not available domestically.

Our global engagements and activities have consistently grown, which has benefited 4 key areas: enhancing our global scientific standing through global partnerships; connecting the domestic innovation system to the global innovation system; attracting foreign investment to Australia; and supporting Australia's foreign policy agenda. We use robust risk management approaches to ensure engagements are in Australia's national interests, including for science and technology diplomacy and for developing enhanced economic partnerships with key regional partners. As well as market outlook, this active scanning approach takes into account geopolitical aspects. Through these planning and risk management approaches, changes to the direction of international commitments are made when required and foreign interference risks are minimised.

Active global strategic partnerships

Partnerships are at the centre of our international focus, and in 2020–21 we worked with 492 international customers and collaborators across more than 70 countries – 325 are multinational private corporations.

These partnerships span our entire portfolio with countries, including the United States, New Zealand, Canada, Chile, Singapore, Vietnam, Indonesia, the United Kingdom, India, Singapore, China and Pacific Islands.

Our focus this year was to prioritise and develop active global partnerships to enable transitions from researcher-to-researcher engagements to organisational partnerships.

To support our Missions program, we partnered with the National Research Council of Science and Technology in Korea to focus on low emissions technology, renewable energy and critical minerals. We also collaborated with the Swinburne University of Technology, the Sumitomo Corporation, Cleantech Japan, GrapheneX, Beyond H^2O, Port Anthony Renewables and ARENA2036 on the Clayton Hydrogen Cluster.

For over 40 years, we have partnered with the Chinese Academy of Sciences, with the partnership continuing to strengthen this year with further involvement from Australian universities and industry. Together we focused on the Blue Economy and on our missions: Hydrogen, Drought Resilience, Trusted Agrifood Exports and Infectious Disease Resilience.

Remote operational guidance offers built-in resilience in underground mining

Mining remains a cornerstone of Australia's economy and is playing a crucial part in the nation's economic recovery through the pandemic. Maintaining productivity while ensuring worker safety are key objectives for the industry. Underground mines are high risk environments with many hazards to worker health and safety.

Our work on mining automation has been recognised and adopted by the industry for decades. Our award-winning longwall automation guidance and navigation systems (LASC) is now licenced to most of the major international suppliers of mining equipment and has been enthusiastically adopted in Australia and overseas. It is currently operating in 26 Australian mines as well as in mines in China and North America. This technology pioneered an automated inertial navigation system (INS) application in underground environments, which enables accurate guidance of mining equipment. This innovation removed workers from the proximity of hazardous mining equipment and has been estimated to deliver up to a 30 per cent increase in efficiency and productivity.

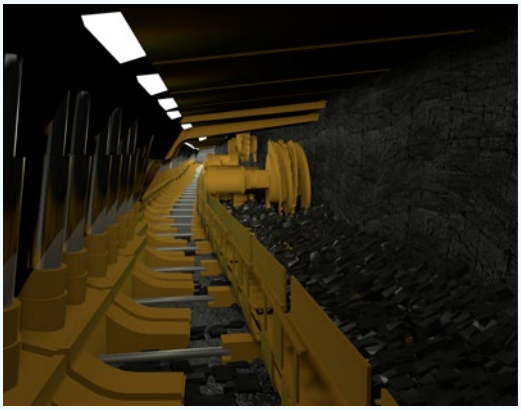
A further innovation has been the development of a 3D laser scanning technology called ExScan. Encased in an explosion-proof casing, the laser scanner and associated software can generate real time 3D maps of tunnels, walls and cavities underground where the global positioning system (GPS) does not penetrate. These maps can be used for locating, steering, and navigating equipment and vehicles.

Together these technologies now give mine operators the ability to remotely operate equipment safely and efficiently underground. The combination has been operating at Glencore's Oaky North Mine in central Queensland. Here the system has been routinely operated from a control room on the surface, removing the workforce from the hazards of underground operations.

The LASC systems allows continued operations despite geological instabilities that would prevent personnel being present on the mine face, and can maintain complex mining operations despite severe restrictions on the movement of personnel from, for example, staff unable to get to sites due to the pandemic lockdown.

Australia has over 700 operational mines across a range of commodities. While the technology was initially developed and deployed in underground coal mines, LASC navigation and ExScan systems are applicable in any underground mining setting, such as gold or copper mines.

LASC continues to build upon its global reputation for leading innovation in underground mining automation.



A graphical representation of longwall automation technology.

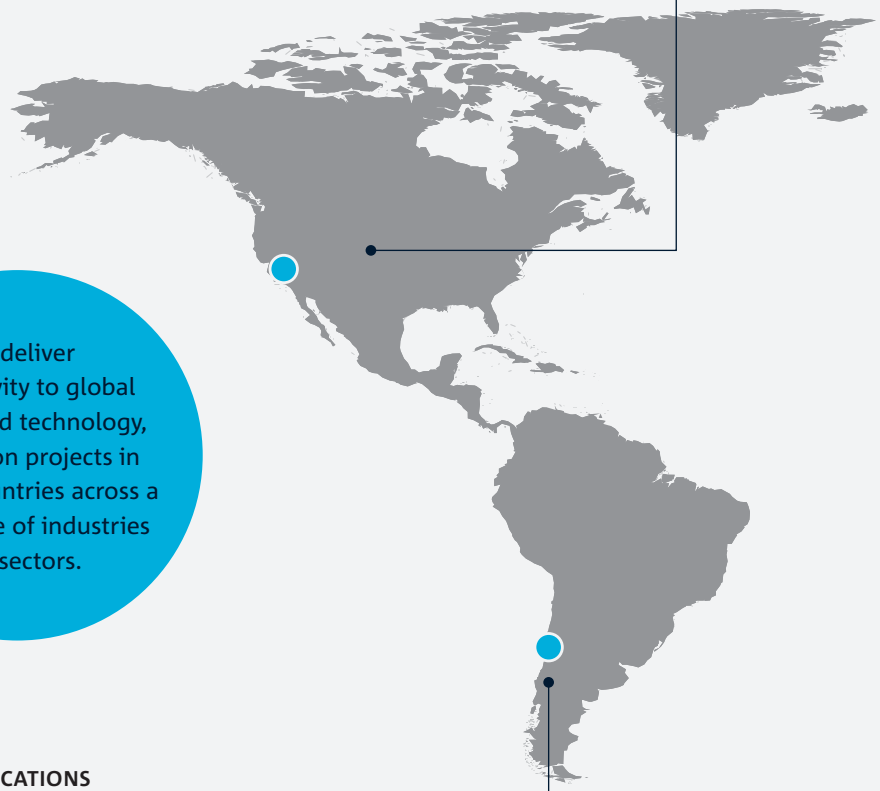
Our global reach

We have strategic presence in international locations to support and focus our global engagements. We have 2 international offices in Silicon Valley, the United States of America, and Santiago, Chile, and one laboratory in Montpellier, France. We also have accredited science counsellors attached to Australian embassies in Singapore, Vietnam and Indonesia

USA

A new, more sensitive blood test for post-surgical bowel cancer recurrence that we developed launched in the USA.

752 15



We deliver connectivity to global science and technology, working on projects in over 50 countries across a wide range of industries and sectors.

JOINT PUBLICATIONS

MOUs

CSIRO OFFICE

CSIRO LABORATORY

EMBASSY REPRESENTATION

Chile

We applied Earth observation data to model water and coasts, land-use and agricultural productivity.

47 3

View our locations on page 135.

France

We focus on environmental and agricultural research with European collaborators from our laboratory at the Agropolis International Campus near Montpelier.

252 3

India

We delivered the virtual Australia-India Circular Economy Hackathon, connecting entrepreneurs and innovators tackling the problem of waste.

80 5

Republic of Korea

We are strengthening our partnerships with Northern Star Resources, focusing on renewable energy and critical minerals.

67 4

Japan

We are forging new partnerships with Japan's Research Institute of Innovation Technology for Earth to collaborate on carbon capture, use and storage.

164 12

Vietnam

We are continuing to manage the Aus4Innovation in partnership with DFAT and the Ministry of Science and Technology in the impact areas of agriculture, food innovation, Earth observation and digital transformation.

24 3

Singapore

We are strengthening our strategic partnership with A*STAR and expanding the low emissions technology testbed to increase export market readiness for Australian innovation.

49 1

Indonesia

We are working across multiple projects, including COVID-19 recovery, peatland forest management and ending plastic marine waste.

19 3

Prioritising key regions for sustained presence and development where there is clear intersection with our impact objectives and sustainable opportunities for Australian innovation

Connecting Australian innovation to global markets

Our Global Strategy creates opportunities for SMEs and the domestic innovation ecosystem to access global markets. With COVID-19 travel restrictions, we developed unique new approaches to support the Australian innovation ecosystem to connect globally.

We are creating an Australian-led innovation lab network with Indonesia, Vietnam, India, China and the United States to profile the ways Australia innovators are making, using, recycling and disposing of plastics, packaging, food waste and energy metals.

Our international scientific partnerships give Australian businesses the opportunity to nominate their priority outputs with international collaborators through research and industry partnership models. We developed a platform with the Agency of Science, Technology and Research (A*STAR) in Singapore to provide Australian businesses with insights into Asian consumer preferences in future protein development and advances in additive manufacturing.

As a key player in Aus4Innovation, we facilitate science, technology and business links between Australia and Vietnam. We worked with the University of Technology Sydney (UTS) and Vietnam National University to bring the UTS Rapido design and engineering model to Vietnam. In late 2020, when a succession of tropical weather systems delivered severe flooding to central Vietnam and affected millions of residents, the Rapido partnership responded by quickly developing community scale water filtration systems to address water quality issues.

We collaborated with Austrade to profile key global science and technology drivers to Australian businesses, including the recent Austrade Health Tech Bootcamps in China, Korea and Singapore.

We are expanding the reach of the Australian developed Open Data Cube technology, which provides a global platform for Australian Earth observation, analytics and sensing.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.7):

1. Recognised as being part of 'Team Australia' in global markets' access to world-class capability and talent.
2. Links for our Australian SMEs and domestic university partners to global markets.
3. Increased value creation for our innovations and services.

National benefits of international projects and activities

In 2020–21, we completed 3 impact case studies that demonstrated the value and benefit delivered to Australia through our global activities, particularly in enhancing the value of our innovations and ensuring a safe and secure region.

Viet-Uc Shrimp Breeding Program

In early 2011, we initiated a selective breeding program with Viet-Uc Seafood Corporation, the largest hatchery business in Vietnam, which accounts for the supply of one third of the Vietnamese L. Vannamei (white shrimp) post larvae market.

Table 3.7: Summary of our performance for accessing new opportunities for Australian innovation

PERFORMANCE MEASURES SOURCE: 2020–21 CORPORATE PLAN	TARGET	RESULT
National benefits of international projects and activities		
Demonstrated by an increasing annual portfolio of impact case studies on global activities, with specific assessment of the value created and national benefit	Evidence of national benefit demonstrated by case studies	**Achieved**: substantial triple-bottom-line benefits have resulted from our work and are demonstrated by 3 impact case studies completed

The research aims to produce a sustainable breeding method of the L. Vannamei, taking into consideration the biological constraints of the animal and practical constraints faced by Viet-Uc.

Our collaboration with Viet-Uc has strengthened cross-country partnerships between Australia and Vietnam. This is enhancing geopolitical security and paving the way for closer trade and investments.

The program has led to system improvements, skills development, genetically improved broodstock and seedstock, and enhanced aquaculture productivity and growth prospects in Vietnam and Australia.

Our Applied Aquaculture Breeding team now has a model for industry engagement that can be applied to other industry partners. Other large-scale projects, such as the monodon and tra fish breeding program and the distribution of Novacq™ in Vietnam, have helped us to develop the expertise and capability to assist similar domestic industries and the issues facing them in the future.

Proficiency testing

The need for Australia to actively participate in the biosecurity of the Asia-Pacific region is more important than ever before.

The risk of infectious diseases transmitting from animals to humans has increased due to the geographic expansion of the population, habitat disruption, and increased global trade and travel.

The Australian Centre for Disease Preparedness (ACDP) plays a critical role in animal disease research and investigation, protecting the public, livestock and aquaculture industries from highly pathogenic emerging diseases. This work responds to the Australian Government's key priority areas, including biosecurity, market access, international relationships and building domestic human capital.

One of the biggest barriers to successful microbiology research is accurate laboratory testing. This is particularly important when detecting, diagnosing and treating viral pathogens, which is required for robust disease surveillance.

Laboratory testing needs to be conducted at the highest possible standard globally to ensure reliability, accuracy and precision.

To minimise laboratory deficiencies, proficiency testing is an external assessment of testing and measurement capabilities that provides additional assurance to internal controls being used by a laboratory.

Proficiency testing is often accompanied by backstopping missions, where field visits are completed by experts to provide an additional layer of assurance.

Despite Asia producing most of the world's aquatic animal products, only ad-hoc proficiency testing occurs for a limited selection of diseases. For the last decade, ACDP has played a leading role in transforming proficiency testing in the Asia-Pacific to a proactive and strategic scientific tool that actively manages biosecurity risks.

We have provided funding, diagnostic expertise and training to 39 animal health laboratories across 14 countries. This proficiency testing is estimated to provide an impact value of $7.06 million.

Our leadership has strengthened the Asia-Pacific's epidemic preparedness and continues to support a safe and secure Australia. It has also maintained our global reputation as disease and pest experts. Read more about ACDP on page 98.

Falling particle receiver

To address the rapidly changing Australian energy market, in 2012 the Australian Solar Thermal Research Institute (ASTRI) was formed to ensure secure, reliable and affordable energy for the future.

ASTRI is a joint venture we have with 6 leading Australian universities to further Australia's capabilities in concentrated solar thermal technology. This technology is a system of integrated components that convert thermal energy into dispatchable electricity in a low lost, renewable way.

The need for a reliable dispatchable renewable energy source has been heightened by global initiatives such as the Paris Agreement, incoming carbon credits for trade, the growing decarbonising industry and the increase in the retirements of coal plants. Optimising energy is an essential requirement for Australia.

As a world leader in concentrated solar thermal technology, ASTRI's work has formed the foundations of the American-led Gen3 Particle Pilot Plant Project. ASTRI is one of the main external contributors to the Sandia falling particle receiver, which is 100 per cent renewable and can store multiple hours of thermal energy for fully dispatchable power generation.

This collaboration has enhanced the resources and commercial opportunities of ASTRI's technology and reduced the risks, costs and timelines associated with the research.

World-leading wheat research bakes in rust resistance with gene stacks

Wheat is one of the world's most important crops, making up 20 per cent of global calorie intake. It is also economically significant, contributing around $6 billion per annum to Australia's agricultural production.

However, wheat is under constant threat from a fungal pathogen called stem rust, which attacks the leaves, stem and flowering parts of a plant. Spores can be spread widely and rapidly via the wind and human factors such as transportation.

While Australia has not seen a widespread stem rust outbreak since the 1970s, the same cannot be said overseas where new threats have emerged. A recent stem rust variant called Ug99 has proven particularly damaging and is capable of destroying entire wheat crop yields in affected areas of Africa where it is currently located.

Our researchers have developed a novel solution to provide protection against Ug99 and other known stem rust variants of commercial significance. Their work saw them cluster 5 individual genes that each provide resistance against stem rust into a single gene stack, making for easy introduction into a wheat variety's genome.

During the year, the team published strong results in the journal *Nature Biotechnology*, demonstrating in field trials and the glasshouse that the approach does convey resistance against a collection of global rust variants.

To make the research a reality, our scientists received strategic funding from the 2Blades Foundation and worked with an international team of researchers from the University of Minnesota (United States of America), Aarhus University (Denmark), The John Innes Centre (United Kingdom), United States Department of Agriculture and Xinjiang University (China).

Rust also frequently mutates, and as we have seen with COVID-19, it has been critical for industry to be able to respond rapidly and develop new resistance to protect a crop that is vital to global food security. Traditional breeding methods can be slow to enact, and there is a high risk of losing resistance genes during the breeding process.

The new approach's success has led to increased numbers of resistant genes being added to subsequent gene stacks. Currently our scientists have added up to 8 genes into a single gene stack in laboratory tests. It is also possible to add more than one gene stack to a plant's genome, which could lead to wheat varieties with rust super-resistance.

While wheat has been the focus of attention to date, the same approach is viable for other cereal crops such as barley, oats, rye and triticale, which are similarly impacted by rust pathogens. It can also be used to target many other pathogen diseases such as stripe rust, powdery mildew disease, rice blast and potato blight.

Named after its likeness to surface rust on metal, wheat rust is highly damaging to crop yields.

1.3: Manage funding directed to industrial scientific research activities, commercialisation of technologies and assistance to industry through research collaboration and capacity building

Our key activities helped us achieve our strategic direction and aspirations:

- Managing the CSIRO Innovation Fund I and conducting a capital raise to build CSIRO Innovation Fund II
- Assisting the Science and Industry Endowment Fund (SIEF) Trustee to deliver grant programs that support scientific research that addresses national challenges.

We delivered on this requirement by:

- CSIRO Innovation Fund, managed by Main Sequence, investing in start-up and spin-out companies, existing SMEs engaged in translation of research, and company formation opportunities to support business growth and a culture of innovation and entrepreneurship in Australia
- SIEF grants to science and scientists for the purposes of assisting Australian industry, furthering the interests of the Australian community and contributing to solving national challenges. Read more about SIEF on page 205.

Main Sequence raised $265 million and launched CSIRO Fund II to continue its mission to solve the world's biggest challenges.

Supporting business growth and a culture of innovation and entrepreneurship in Australia

The CSIRO Innovation Fund, managed by Main Sequence, invests in translating publicly funded Australian research into extraordinary global companies that create jobs and grow our economy.

In 2020–21, Main Sequence raised $265 million to launch Fund II and continue its mission to solve the world's biggest problems in health, food, space, decarbonisation and industrial productivity by turning science and research into breakthrough companies, such as Endua, Eden Brew and Quasar Satellite Technologies. Read more about Quasar on page 50, Eden Brew on page 49 and Endua on page 80.

Main Sequence pioneered a venture science model, which is an approach that starts by identifying a big challenge. It brings together science, industry, founders and investment to solve it through company creation.

In the wake of COVID-19, Australia is turning to science and technology to help grow new industries, and Main Sequence is positioned to drive greater commercialisation of Australian research to fuel the nation's economic recovery.

Since 2017, the Fund has helped to build 33 deep technology companies, which have created over 850 technology jobs.

'Our first fund has helped build some amazing companies that are doing everything from making healthcare more equitable to revolutionising the way food is produced and increasing industrial productivity. This new fund will help us continue this pivotal work to solve the world's biggest challenges through investment in science-powered companies.' Mike Zimmerman, Partner at Main Sequence.

Endua launches to build next generation of clean energy storage, powered by hydrogen

Off-grid industries and regional communities often rely on electricity from generators running on diesel, which are expensive and have a negative effect on air quality and greenhouse gas emissions.

Endua, a new Australian energy storage start-up we founded with Main Sequence and Ampol, the country's largest fuel network, launched to build hydrogen-powered energy storage to deliver sustainable, reliable and affordable power.

Endua's hydrogen-based technology will make it possible for regional communities, towns and industries like mines and remote infrastructure to become self-sustaining from the grid using only renewables.

Endua will build breakthrough clean power generation and storage in a modular power bank that can drive power loads of up to 150 kilowatts in a single pack.

We have been a pioneer in hydrogen technologies for over 15 years, and our technology developments enable hydrogen-based power generation and storage that is truly modular and built for the long-term. The company will use our newly developed electrolysis technology to produce hydrogen within the device, leveraging our pioneering science and experience to make it possible to store and deliver renewable energy in a cost-effective way compared to traditional fossil fuel sources like diesel generators.

Ampol has backed Endua as part of its Future Energy and Decarbonisation Strategy. Ampol will bring industry and customer knowledge to help develop, test and commercialise the technology, leveraging the increasing need for low carbon off-grid alternative energy.

'We are rapidly transitioning to renewable energy to power our homes, our transport and our businesses. After being exposed to the energy sector through my work with Tritium, it was clear there was still work to be done in Australia's transition to renewable energy. Solar, wind, hydro and batteries all play a part in getting us to net zero. Yet there are places and situations where these sources won't get us all the way there. Hydrogen will play a crucial role in our transition but only with the right technology and business model to make hydrogen power generation and storage cost-effective. Endua is making both achievable. We believe it's possible to give everyone access to clean power, whether in the city or the outback. We're solving the hardest problems in the move to net zero, for all purposes, not just those that 'fit' the renewables profile,' said Endua Chief Executive Officer, Paul Sernia.

Endua Chief Executive Officer Paul Sernia and CSIRO lead scientist on hydrogen research Dr Sarb Giddey.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcome (see Table 3.8):

- Australian industries maintain and improve their competitiveness through the application of new technologies and solutions.

Strategic investments by SIEF in scientific research to address national challenges for Australia

This year, SIEF continued its strategic purpose of investing in scientific research that addresses issues of national priority for Australia. Recognising that science has been, and will be, a key driver of Australia's economic, industrial, environmental and cultural development, SIEF invests in research that contributes to the sustainable growth of Australia. It delivers grant programs to support scientific research that address national challenges and programs in STEM education pathways and employment in New South Wales.

The Experimental Development Program (EDP) addresses the gap in funding for progressing technology development to a stage suitable for attracting commercial investment and market uptake. Engagement with industry is an intrinsic part of each project, ensuring that technologies meet industry's and society's needs. The Trustee approved 3 EDP projects this year in the priority areas of health, manufacturing and energy. SIEF supported 6 EDP projects in 2020–21.

The Megasonics EDP project aimed to improve the processing efficiencies of olive oil extraction for increased productivity and revenue, while maintaining the olive oil's properties and preferentially using only physical means. SIEF provided funding to construct a pilot plant to process olives at a rate of 2,000–3,000 kilograms per hour and trials to evaluate and demonstrate extra virgin olive oil recovery, oil quality and shelf life in an operational environment. The application of high-frequency ultrasound standing waves (megasonics) provided improvements in extra virgin olive oil recovery of up to 3.9 per cent and an increase in phenolic compounds in the olive oil. This creates a healthier product while maintaining the sensory and chemical properties characteristic of extra virgin olive oil. Read more about Megasonics on page 209.

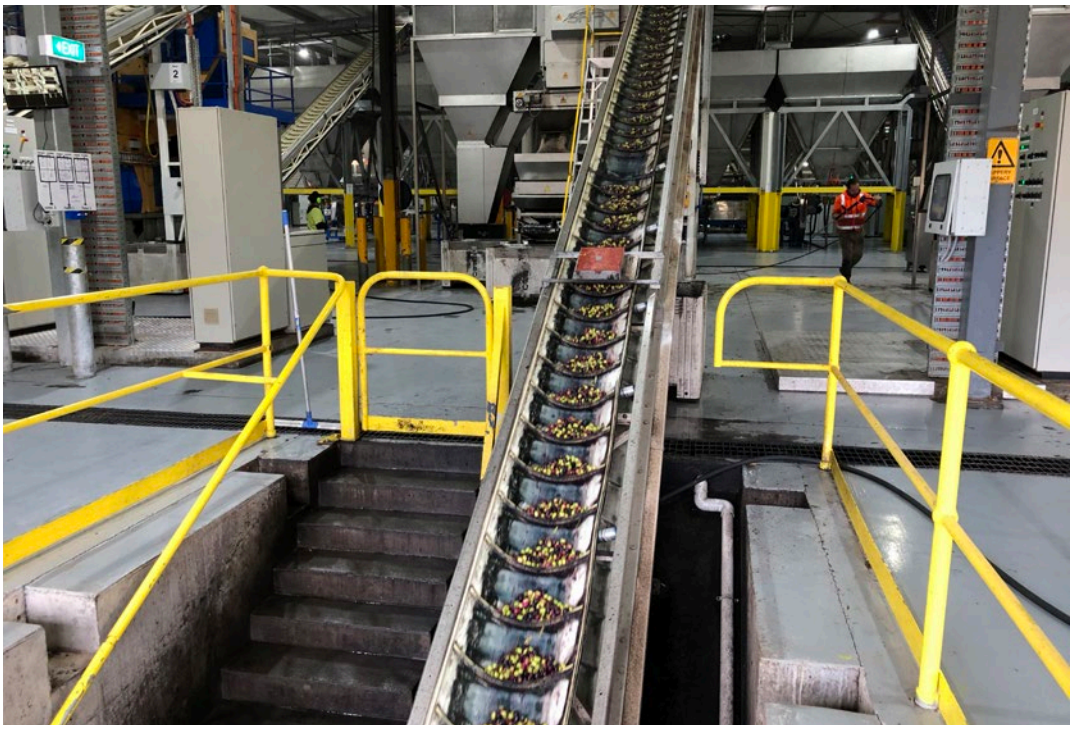
Table 3.8: Summary of our performance for managing funding directed to industrial scientific research activities

PERFORMANCE MEASURES SOURCE: 2020–21 CORPORATE PLAN	TARGET	RESULT
Strategic investments by SIEF in scientific research to address national challenges for Australia		
SIEF invests in programs aligned with published strategic objectives that address national challenges and contribute to Australia's sustainable future	Evidenced by an impact case study or evaluation for each active SIEF program	**Achieved**: Megasonics Experimental Development project and the Digital Initiatives project completed

The Future National ICT Industry Platform Program provides funding for large-scale research activities (Digital Initiatives) in information and communications technology for the benefit of Australia. It creates new Australian technology-based industries or applied technology platforms that can reach a global scale.

The Supply Chain Integrity Digital Initiative is addressing the national research priority of enhancing food production through novel technologies integrated into the production chain. Completed in early 2021, the digital initiative developed technologies that validate claims about the origin of a product, its authenticity and adherence to ethical production practices, and improves efficiencies for producers using the red meat sector as a use case. These technologies will protect Australia's reputation as a trusted supplier of premium food products. Read more about the Supply Chain Integrity Digital Initiative on page 208.

The Generation STEM program delivers education programs to support scientific research and employment in New South Wales. COVID-19 impacted the ability to continue face-to-face outreach. However, it provided opportunities to develop virtual events and online resources, including a virtual student showcase event in December. Generation STEM continues to increase education pathways and employment opportunities for New South Wales students, including those in regional and remote areas. Read more about Generation STEM on pages 85 and 206.



Ripe olives being conveyed into the megasonic assisted olive process.

Objective 2:

Mobilise and develop the best talent for the benefit of Australia

Our second objective is addressed by a single requirement:

REQUIREMENT		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
2.1	Promote STEM capability development and education.	Pages 84–92	Page 94

The outcomes expected from this objective:

1. Australia's science capacity increased, which helps the nation to remain innovative and competitive in science.
2. Increased awareness and understanding of science and its potential benefits to the community and industry.
3. Increased industry participation in CSIRO education and outreach activities.

2.1: Promote STEM capability, development and education

Our key activities helped us achieve our strategic direction and aspirations:

- Continuous improvement of STEM programs
- Increase SME engagement.

We delivered on this requirement by:

- providing opportunities for students and teachers to develop and improve STEM skills, including access to mentors
- offering education and outreach activities to increase knowledge of STEM and its application to students, parents, teachers and the Australian community
- publishing a variety of content, including journals, books and magazines, to support an increased knowledge of science and its application
- working with SMEs to develop capability both within industry and the research sector to support innovation in SMEs.

Continuous improvement of STEM skills and knowledge

Our programs deliver immersive STEM learning experiences for school and undergraduate students, teachers, researchers and the community. In collaboration with industry and our partners, we bring STEM to life for more than 160,000 students nationally each year. Our programs are curriculum aligned, culturally responsive, and use best practice STEM teaching methods. We promote the importance and application of our research to the community and increase Australia's STEM literacy.

School programs for students and teachers

We delivered more than 16 education programs, which increased interest, engagement and achievements in STEM. This year, more than 160,000 primary and secondary students took part in STEM education programs from more than 3,800 schools. More than 3,600 teachers participated in professional learning programs and experiences.

The STEM Professionals in Schools program is Australia's largest national skilled volunteering program for STEM professionals and classroom educators. This year, the Government's Budget included $4.8 million to extend the program to 2024–25. At the end of June, 1,284 partnerships were operating in 864 schools, which consisted of 1,060 teachers and 1,011 STEM professionals from more than 340 organisations across Australia. The schools that participated were spread across the government, Catholic and independent sectors and included an even split of primary, secondary or combined schools. Of these, 43 per cent were in regional and remote areas.

This year, we piloted an online regional and remote initiative after we consulted with our industry and education stakeholders. We held 3 interactive webinars about the planning, delivery and evaluation of partnership activities. Seven cohorts were run in Term 4 2020 and Term 1 2021, which led to 83 partnerships. This has connected STEM professionals with teachers aligned to their areas of interest from regional and remote areas of Victoria, New South Wales, Queensland, Northern Territory, Tasmania and South Australia.

This year, the program also received additional funding from DISER as part of the Inspiring Australia: Science Engagement in Australia Programme. We delivered 5 online partnership support events and 7 partnership STEM career profile pieces, which have been shared via multiple channels, including targeted media, owned media and social media platforms. We also created new online learning modules to further support program participants.

Generation STEM

Generation STEM is a 10-year initiative that attracts, supports, retains and trains NSW students in STEM into further education and employment. In 2020, over 150 Year 9 and 10 students from 8 high schools participated in the STEM Community Partnerships Program as part of Generation STEM. Students attended face-to-face and virtual STEM engagement activities and events throughout the year, including site visits, careers events, workshops, work experience and masterclasses. Participation numbers were considerably impacted by COVID-19; however, we have made significant progress to expand the program in the first half of 2021.

Seven councils in Western Sydney, 55 schools and over 1,205 students participated in the program in 2021. Generation STEM facilitated 6 school information sessions, 7 industry engagement workshops and 6 teacher professional learning days over the first 4 months of 2021. In total, approximately 330 participants attended these sessions and, as a result, many committed to be involved in the program.

Work is underway to expand the STEM Community Partnerships Program to at least 2 regional locations in New South Wales, and to launch 2 new Generation STEM programs in the second half of this year. Read more about Generation STEM on pages 82 and 206.

The Digital Careers initiative aims to increase student participation and interest in ICT careers through programs, including Bebras and CyberTaipan. Bebras promotes computational thinking for Years 3–12 students. This year, over 54,000 students participated in the Bebras Australia Computational Thinking Challenge, including over 32,000 students in March. The largest Bebras Australia challenge, CyberTaipan, is a cyber security competition modelled on the United States' Air Force Association's CyberPatriot program, which educates and inspires students towards further education and careers in cyber security and other STEM subjects. High school students act as newly hired IT professionals who need to protect a small company's network. Digital Careers partnered with Northrop Grumman Australia to scale the CyberTaipan competition across Australia. We successfully shifted the competition to an online environment due to COVID-19 and engaged 34 schools, 80 teachers, mentors and volunteers, and 413 student participants.

Engaging high school students

The GFG Foundation Student Programme, a partnership we have with the GFG Foundation and Prince's Trust Australia, increases high school students' engagement with STEM skills. The Programme recruited 27 Year 9 and 10 students from 3 high schools in Whyalla, South Australia, and 20 students graduated in December. In response to COVID-19, the delivery model was adapted to online sessions and students engaged virtually from their schools. Six mentors from GFG, Simec Mining and Liberty Steel supported the students along with 3 volunteer teachers. Students graduated the programme with a CREST Bronze award and a trophy, which recognised their community-based inquiry projects. In November, the Programme expanded to include Newcastle and planning is underway to deliver it from our Energy Centre.

The PULSE@Parkes program gives high school students the opportunity to control the Parkes radio telescope. Read more about our Parkes facility on pages 100 and 128. Due to COVID-19, this year, we delivered the program remotely, which allowed more schools from regional and remote areas to participate. As part of the changes, we developed a new website and online activities. We delivered sessions to 180 students in 20 schools in 5 states and territories. We held special sessions for: 15 Year 9 and 10 students from New South Wales and Western Australia as part of the Young Indigenous Women's STEM Academy; 12 BHP Foundation Science and Engineering Awardees; and 3 students as part of a week-long Virtual Work Experience program. In February, we held an online teacher professional development workshop for 12 teachers and 15 third-year undergraduate vacation scholars.

The Creativity in Research, Engineering, Science and Technology (CREST) program enables teachers to build capacity for facilitating open inquires. This year, we engaged 182 schools and students completed 1,686 investigations in science, technology and engineering projects. We added to the suite of CREST resources, expanded our teacher professional learning offerings and delivered 5 online professional learning workshops to 132 attendees. We commissioned an explorative report to review the mathematical learning opportunities across the current CREST resources and identify opportunities to expand the program. As a result, in May we developed and launched 2 new mathematical inquiries.

At the Queensland Association for Gifted and Talented Children conference, we presented the CREST award program as part of the *Partnerships for Challenge in STEM Subjects* with the Science Teachers' Association of Queensland. This year, many of the deliverables and achievements in CREST were possible due to funding from the Australian Government's Inspiring Australia: Science Engagement Programme.

Outreach to increase knowledge

The CSIRO Discovery Centre offers an interactive journey through Australian science history and showcases our innovative science and technology. Due to COVID-19, the Centre was closed from 19 March 2020 and reopened on 3 February 2021. Our programs were modified to a virtual format for schools, families, teachers and the general public. Significant exhibition upgrades were undertaken over this time. School visits resumed in February. More than 180 schools, 10,207 students and 998 teachers participated in programs, mostly from New South Wales, Victoria and Queensland. In addition, 197 community members visited the Centre.

Table 3.9: Science outreach: visitor centres

CENTRE	2016–17	2017–18	2018–19	2019–20	2020–21
CSIRO Discovery Centre	26,332	27,622	32,122	23,269	11,402
Parkes radio telescope	83,851	105,085	112,224	100,103	103,185
Canberra Deep Space Communications Complex	70,753	69,279	68,581	47,814	22,249
Australia Telescope Compact Array, Narrabri	10,965	12,081	10,363	7,434	19,659

Visitor numbers to the Canberra Deep Space Communications Complex dropped significantly as it was only open to the public during the December – January holidays and the two-week April holidays.

Tertiary students

We collaborate with universities, industry and other stakeholders to provide postgraduate studentships, undergraduate traineeships (previously called industrial traineeships) and vacation studentships for undergraduate students.

This year, the 3 programs were refreshed to improve the CSIRO student experience and reflect the changing research environment. The postgraduate studentship changes reflected the aim for Australian research to increase collaboration with industry. This supports postgraduate students to look for careers outside of academia.

The revised postgraduate studentships include sponsored studentships via a full or top-up stipend, supervised-only studentships, the Industry PhD program, or postgraduate internships.

As part of the tertiary student programs, students complete research projects that provide learning and development opportunities, which supports the increasing demand for Australia's STEM capability.

In the 12 months to 31 May, we supported 1,455 undergraduate and postgraduate students through our programs, represented in Table 3.10. The number of students fluctuates within a year and across years, as students start and finish programs at different times of the year. The decrease in student numbers this year is because of COVID-19 related restrictions, including the closure of national and international borders, site closures and uncertainty about how restrictions may continue in the future.

Table 3.11 provides a breakdown of the number of students that we supervised, or both supervised and sponsored. These numbers represent a point in time as at 31 May 2021, as distinct from the total number of students over the course of the whole year.

Tertiary student programs

The Undergraduate Research Opportunities Program (UROP) facilitates student job placements in research laboratories. This year, 21 students worked in UROP placements in 9 research organisations: CSL, the University of Melbourne, the Walter and Eliza Hall Institute of Medical Research, the Florey Institute of Neuroscience and Mental Health, the Alfred Hospital at Monash University, the Australian Regenerative Medicine Institute, RMIT, the Hudson Institute of Medical Research and the Peter MacCallum Cancer Centre. In July, the program delivered its conference virtually to allow people to participate during COVID-19. The 2-day event attracted 60 people on the first day and 50 people on day 2. The UROP team scheduled regular check-ins with ongoing UROP participants to support them during COVID-19 disruptions. Evaluation showed that UROP helped students to confirm their chosen career path and their aspirations for further study; students valued the experience; and supervisors saw the program as a pipeline for acquiring talent.

Vacation Scholarship program

We engaged Aboriginal and/or Torres Strait Islander university students through our Undergraduate Vacation Scholarship program. The Young Indigenous Women's STEM Academy employed 5 vacation scholars to support the Virtual STEM Experience. These scholars designed and delivered virtual workshops in maths, engineering, technology, science, wellbeing and internet safety for Year 9 Academy students. Academy staff can now deliver the workshops virtually or face-to-face. The vacation scholars continue to share their experiences of developing the workshops through guest speaking opportunities at assemblies and camps and to Master of Science Communications students at the Australian National University.

The Inquiry for Indigenous Science Students (I^2S^2) program engaged 2 vacation scholars. The scholars undertook a comprehensive review of the online learning modules and teaching resources to align with our style guide. One of the scholars, a Law student, was invited by our Office of Indigenous Engagement to participate in the internal Indigenous Cultural and Intellectual Property Working Group. The scholar has been employed as an Education Adviser for the Inquiry for Indigenous Science Students' team.

The Science Pathways for Indigenous Communities program engaged one vacation scholar to develop online science education resources in conservation and land management research, ethnobiology, cultural mapping and two-way science facilitation.

Table 3.10: Our students over the past 12 months

TYPE OF ENGAGEMENT	2017–18	2018–19	2019–20	2020–21
Tertiary level				
Undergraduate students	633	529	485	376[2]
Postgraduate students	1,438	1,456	1,392	1,079
Total	**2,071**	**1,985**	**1,877**	**1,455**

Table 3.11: Our supervised and sponsored students at 31 May each year

	2017	2018	2019	2020	2021
Sponsored and supervised postgraduates					
PhD	416	418	390	451	403
Masters	27	12	7	7	16
Subtotal	443	430	397	458	419
Supervised postgraduates (not sponsored)					
PhD	257	398	422	337	254
Masters	88	147	137	84	57
Subtotal	345	545	559	421	311
Subtotal postgraduates	**788**	**975**	**956**	**879**	**730**
Undergraduates					
Industrial trainees	0	100	100	56	46
Honours students	84	74	54	48	46
Subtotal	0	174	154	104	92
Total tertiary students	**0**	**1,149**	**1,110**	**983**	**822**

2 Includes 203 vacation students

Indigenous STEM Education programs

The Young Indigenous Women's STEM Academy provides high-quality STEM extension and engagement activities to young Indigenous women. The program currently supports 191 students across Australia from Year 9 through to university. The Academy engaged female Indigenous STEM Professionals to present the Strong in STEM series – virtual panel discussions that featured 12 female Indigenous STEM professionals. We are currently recruiting students across Western Australia, New South Wales, Queensland and the Northern Territory for the 2021 cohort.

In June, the Indigenous STEM Education Project concluded its delivery phase after 6 years of national scale impact. Funded by the BHP Foundation and delivered by CSIRO, the Project increased the participation of Indigenous students in STEM across the country.

The I^2S^2 program continued to provide teachers with the tools and understanding to embed Aboriginal and/or Torres Strait Islander perspectives into the Australian Curriculum and increase student engagement and achievements. We transitioned the course to be completely online, and this year, 523 teachers used the learning management system, compared to 166 teachers in the previous year. Since we moved to an online delivery method, we have recruited 658 new schools to the I^2S^2 program from all Australian state and territories. The 5-module course expanded to include Teaching Mathematics, which was co-designed with Professor Chris Matthews and the Aboriginal and Torres Strait Islander Mathematics Alliance.

The Indigenous STEM Awards recognise and reward Aboriginal and Torres Strait Islander STEM professional and student achievements as well as schools, teachers and mentors. In February 2020, 12 winners were announced – 2 winners received their awards in-person prior to pandemic restrictions and the remaining 10 winners celebrated via an adapted program in the second half of 2020. We held virtual panels and presentations that enabled winners' local communities and guests from across the country to participate. School-based awards were presented face-to-face and winners were celebrated at assemblies and school community events, such as cultural programs and congratulatory messages from partners, collaborators and ambassadors.

Last year, summer schools for the Aboriginal Summer School for Excellence in Technology and Science (ASSETS) were not held; however, program staff continued to support and engage alumni. In November, we held a virtual launch event for the ASSETS destination interview report, which included a panel of ASSETS alumni. We held online events, including check-ins and networking with alumni, and 4 alumni continued with their CSIRO cadetships. Four ASSETS alumni were also selected through a nationally competitive process to undertake vacation scholarship positions with us.

This year, the Western Australian Government announced a pilot program based on the Science Pathways for Indigenous Communities program. The proposed initiative will build on the success of our program to provide educators with resources and learning opportunities to further expand two-way science in the state. The initiative will encourage schools and teachers to build partnerships with local Aboriginal communities and Elders to develop culturally responsive learning programs that connect Indigenous ecological knowledge to the Australian Curriculum. We will transfer the knowledge and evidence we've gained from the Indigenous STEM Education Project so that more students, teachers and communities benefit from our approach.

Virtual program delivery

In response to COVID-19, we transformed several of our programs and activities to digital and virtual experiences, which maintained our participant engagement and our program's impact.

In November, the BHP Science and Engineering Awards offered 24 primary school finalists a virtual tour of a scientific facility, which included a question-and-answer session with one of our scientists, a career talk from a BHP engineer and a conversation with an awards alumnus. In December, 23 secondary school finalists that represented 17 projects engaged in a 4-day Virtual Secondary Awards Experience. They received virtual tours of scientific institutes, heard presentations from scientists and engineers, and attended networking events. Students presented their projects to a panel of STEM professionals and peers and attended an evening event, which included keynote speakers and virtual breakout table discussions. In May, 6 student project teams were selected to virtually attend the Regeneron International Science and Engineering Fair. In December, 9 teachers participated in the Virtual Teacher Best Practice seminar.

Based on the successful Science Pathways for Indigenous Communities program, we developed a Two-way Science for Australian Schools online module to introduce school leaders to the principles and methodology articulated in *Two-Way Science, An Integrated Learning Program for Aboriginal Desert Schools*.

In December, the Generation STEM program delivered its first virtual student project showcase. The innovative website featured contributions from enthusiastic students about the solutions they developed to local challenges, as well as video messages from council staff, industry partners, mayors from participating councils, and the Minister for Skills and Tertiary Education, The Hon. Dr Geoffrey Lee. Read more about Generation STEM on pages 82 and 85.

Developing early career researchers

CSIRO Early Research Career Postdoctoral Fellows

Our CSIRO Early Research Career (CERC) Postdoctoral Fellowship program provides a differentiated learning and development program to develop future leaders of the innovation system. These Fellowships enhance the person's research capability for a career in research at CSIRO or beyond.

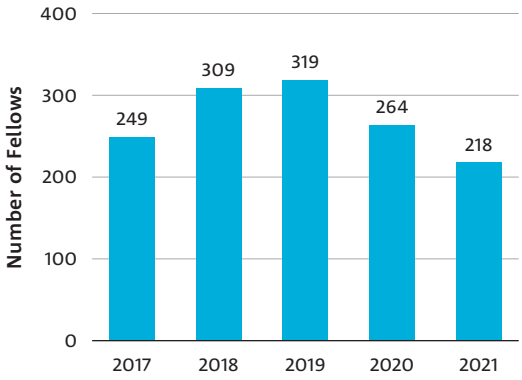
Due to COVID-19, we implemented a support program for Fellows due to end their terms in December, which resulted in 45 CERC Postdoctoral Fellows' terms being extended by 6 months.

Figure 3.4 shows that, since 2019, CERC Postdoctoral Fellow numbers have declined, attributed to uncertainty and border restrictions. As Fellows have concluded their terms and new Fellows have been appointed during the year, a total of 345 different Fellows have been employed throughout the year.

In July, we commenced a fast-track recruitment program, which resulted in 47 new positions for Australian citizens, permanent resident holders and international students currently in Australia. This increased opportunities for postgraduates who would normally be seeking opportunities overseas.

We increased our university and industry engagement with Postdoctoral Fellows being employed at universities. At the end of June, there were 59 Affiliate Postdoctoral Fellows.

Figure 3.4: CERC Postdoctoral Fellows as at 30 June



Publishing and supporting an increased knowledge of science and its application

CSIRO Publishing operates as an editorially independent science publisher for authors and readers in Australia and overseas. Our publishing program of books, journals and magazines covers a range of scientific disciplines, and we are Australia's only scholarly science publisher with significant digital capabilities. Our publications and services improve decision-making, contribute to the growth of STEM-enabled innovation and enrich lives through access to knowledge.

Open Access

This year, we focused on finding a viable way to transition our scholarly journals publishing model to Open Access (OA), which has the potential to increase the reach of our published research while maintaining high standards of peer review and publishing practices.

OA makes scholarly outputs freely available online for users to read, download, copy, distribute, print, link to full text, crawl for indexing, pass as data to software or use for any lawful purpose, without any financial, legal or technical barriers.

CSIRO Publishing has OA agreements with over 20 university and research libraries, which allows authors access at no cost. These transitional agreements are funded by the institutions' libraries via subscription fees.

This year, the STM Association coordinated timely access to COVID-19 research, and CSIRO Publishing made our COVID-19 research available for free, immediate access. This will continue for the duration of the pandemic.

In 2020–21, we published 27 journal titles. Fourteen were published in partnership with the Australian Academy of Science. This successful relationship dates back to 1948. In 2020, we signed a new five-year agreement.

Twelve journals were also produced under agreements with Australian and international societies or institutions. We established a new relationship with the Bureau of Meteorology, under which we will publish the *Journal of Southern Hemisphere Earth System Sciences* for the next 5 years.

Book program

This year, CSIRO Publishing released 33 book titles. Digital books comprised approximately 10 per cent of sales.

Our books program grew, and we received the Whitley Medal for *Hawkmoths of Australia: Identification, Biology and Distribution,* and a shortlist nomination in the Children's Book Council of Australia Awards for *Hold On: Saving the Spotted Handfish*. We also published several books with activities and puzzles that promote engagement and interest in science from an early age based on our children's magazine *Double Helix*.

Writing is an essential skill for scientists. Without it, their research remains unknown and unlikely to have an impact.

Writing is an essential skill for scientists. Without it, their research remains unknown and unlikely to have an impact. Through our Scientific Workshops, CSIRO Publishing has been training our scientists, universities and government agencies to write for more than 10 years. The workshops are now presented as modular, online learning programs with highly interactive webinars, practical writing and editing activities, and regular feedback sessions.

Working with SMEs to develop capability and support innovation

SME Connect supports collaboration between Australian industry and publicly funded research institutions by bringing SMEs together with Australia's best researchers and facilities. We work with SMEs across Australia to support and enable innovation through funding, expertise and resources.

This year, we facilitated 339 research projects nationally for 249 companies, which injected more than $35 million into the research and development of these projects. Of these projects, 275 were delivered by 40 Australian research organisations, including 34 universities and CSIRO, and 64 were grants for recent graduates to work on in-house research projects for SMEs.

We delivered 3 programs this year: Innovation Connections, funded by the Australian Government as part of the DISER Entrepreneurs' Programme; SIEF Ross Metcalf STEM+ Business Fellowship program, funded by SIEF (read more on page 206); and CSIRO Kick-Start, a strategically funded activity.

Innovation Connections

Innovation Connections assists businesses to understand their research needs and connect with the research sector. It also provides dollar-matched funding for research and development projects with universities and research organisations. Incubator Support provides funding to help start-ups develop capabilities to succeed in international markets.

We were appointed the national delivery partner for Innovation Connections and Incubator Support, part of the Entrepreneurs' Programme. To deliver this program, we are working with Ai Group, the New South Wales Business Chamber, Business South Australia, Deloitte, i4 Connect and Darwin Innovation Hub. We received DISER funding to employ 18 facilitators in Perth, Adelaide, Melbourne, Hobart, Canberra, Wollongong, Sydney, Central Coast, Newcastle, Gold Coast, Brisbane and Townsville.

CSIRO Kick-Start

To support start-ups and small businesses in Australia to develop, refine and enhance their innovations, CSIRO Kick-Start provides dollar-matched funding to conduct research with us, use our facilities, and facilitate collaboration between the business and our research staff. The intention of CSIRO Kick-Start is to help start-ups and small businesses to access affordable, high-quality research and development expertise though subsidised research. This has enabled participating SMEs to make the next business step, which has led to new investments and capital raising – a first, new or expanded product or service for new customers. The program is reported as being well-executed and an important way to introduce our research capabilities to up-and-coming Australian businesses, providing a well-regarded entry point to long-term client relationships.

SIEF Ross Metcalf STEM+ Business Fellowship

The SIEF Ross Metcalf STEM+ Business Fellowship program supports 2- to 3-year STEM+ Business projects being delivered by early career researchers to innovative Australian businesses. Since it commenced in 2016, STEM+ Business has supported 42 projects and a further 6 projects commenced this year. Read more about the SIEF Ross Metcalf STEM+ Business Fellowships on page 206.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.12):

1. Increased science capacity, which helps the nation to remain innovative and competitive in science.
2. Increased awareness and understanding of science and its potential benefits to the community and industry.
3. Increased industry participation in CSIRO education and outreach activities.

Table 3.12: Summary of our performance for developing national science talent

PERFORMANCE MEASURES SOURCE: 2020–21 CORPORATE PLAN	TARGET	RESULT
Help lift Australia's science capacity and capability		
Demonstrated contribution to national scientific literacy through delivery of STEM programs as evidenced by an annual program evaluation of STEM program delivery	Evidence of contribution to scientific literacy	**Achieved**: program evaluations demonstrated positive outcomes

Innovating bauxite products

Australia is the world's largest producer of bauxite, a sedimentary rock with a relatively high aluminium content. Australian Bauxite (Abx), a mining and exploration company with tenements across Queensland, New South Wales and Tasmania, were looking to increase the value of their bauxite. They were investigating the use of new technology developed in their Alcore project to convert bauxite into aluminium fluoride.

Feasibility

Preliminary results demonstrated that the process was feasible, but ABx needed to understand the process more deeply and optimise their processes through better characterisation of materials.

ABx applied for an Innovation Connections grant under the Australian Government's Entrepreneurs' Programme to progress the Alcore project by collaborating with our researchers to optimise and test their technology that would convert bauxite into aluminium fluoride.

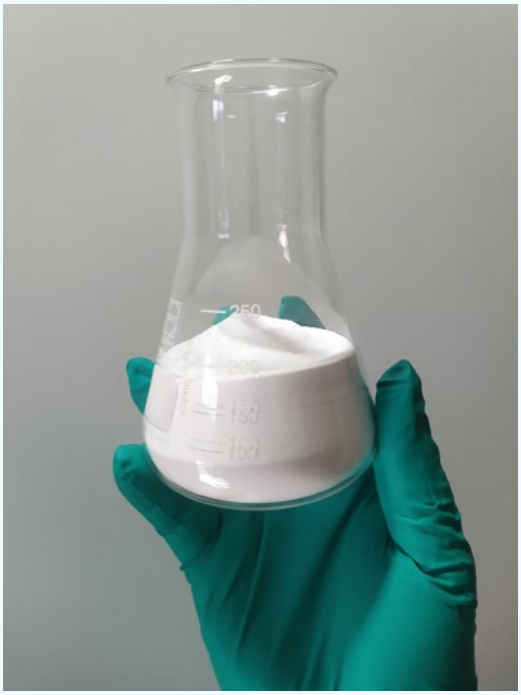
Exploration outcomes

The grant also supported the placement of one of our researchers, who was seconded from CSIRO, to work on the project alongside our researchers and using ABx's facilities.

ABx has commenced its second project to further develop this offering.

Success has allowed the business to have a greater value revenue stream associated with its bauxite product as well as a technology offering in the marketplace to diversify revenue streams.

The grant allowed the team to rapidly and effectively connect with scientific expertise that accelerated the development of the Alcore project.



Australian Bauxite: innovating bauxite products.

We implement the CSIRO Impact Framework to measure the impact of our programs. Here are some examples from 2020–21.

STEM Professionals in Schools program

We engaged an external consultancy to conduct an impact evaluation of the STEM Professionals in Schools program. It found the program delivered great benefits to program participants, including teachers and STEM professionals, and the broader community, and that students' engagement in STEM increased as a result of the program. The evaluation noted the scope of the program has evolved from having a purely science focus to a more encompassing and integrated STEM focus.

The main strengths of the current program included our strong, positive reputation that attracted people to the program; our highly flexible partnerships between teachers and STEM professionals, which allowed them to meet their specific needs; and students' exposure to real-world STEM experiences, which led to increased engagement and interest.

The program had positive national impacts on teachers, STEM professionals, students and the community with 10 per cent of schools from across the country having a teacher involved in a program.

Indigenous STEM Education Project

We released 3 evaluation reports about the Indigenous STEM Education Project that demonstrated its positive impact on Aboriginal and/or Torres Strait Islander students, teachers, schools and communities.

In August, we received an evaluation report for the Science Pathways for Indigenous Communities program, which found:

- strong, effective partnerships were established with schools and other stakeholders, and program staff contributed to the structure, resourcing and planning and modelled respectful relationship development skills to support educators to make local connections
- the program increased student and community member engagement in education
- educators' confidence and capacity to plan and undertake two-way science (and teaching science in general) using on-country contexts improved
- the program improved a school's capacity to embed Aboriginal ecological knowledge and Western science into the curriculum due to a more frequent and effective focus on science and resources that were place-based and easy to use.

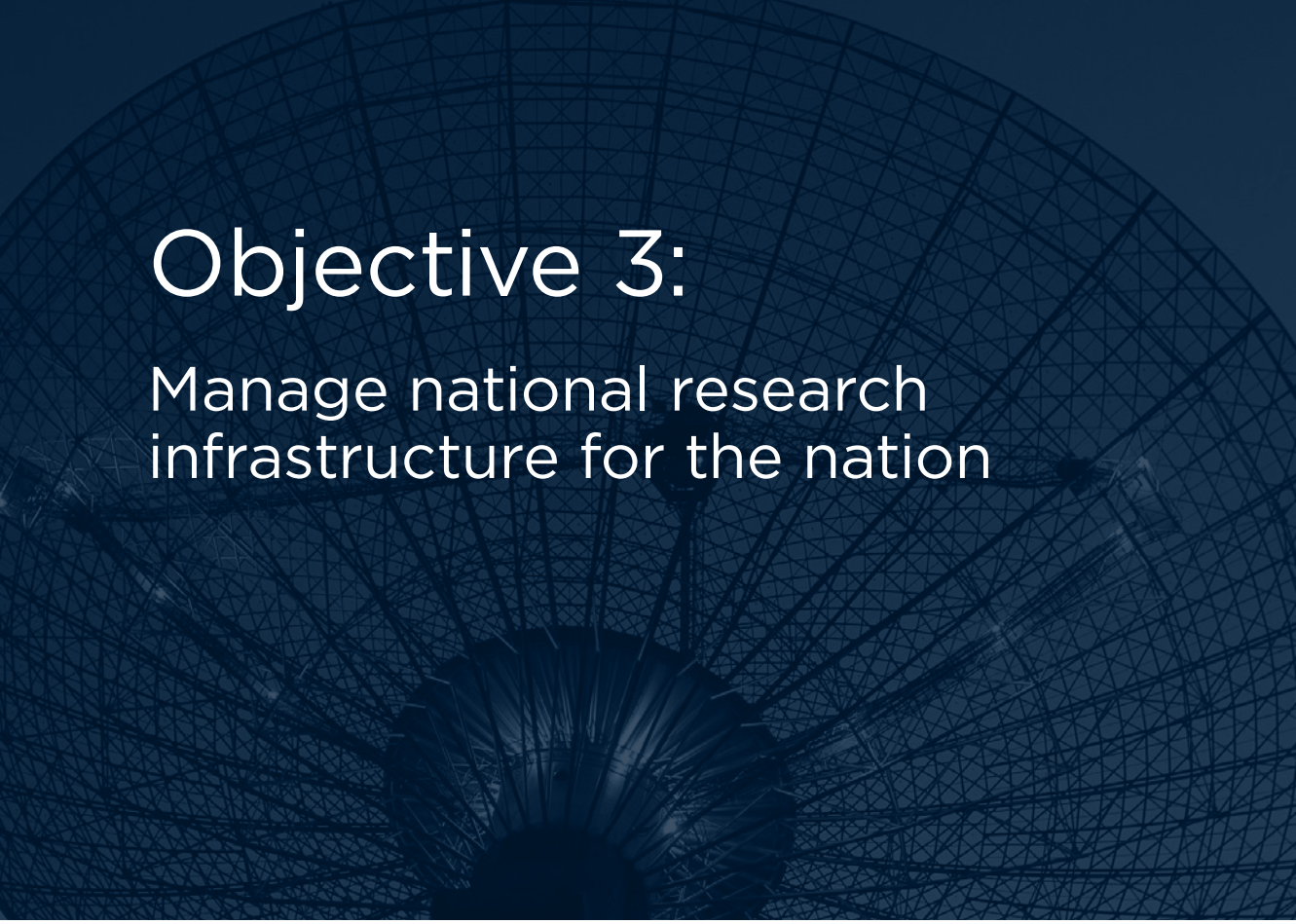
We conducted interviews with 10 ASSETS alumni to better understand how the program has impacted them 5 years after completing the program. All 10 alumni are currently engaged in higher education degrees, including 8 in STEM-related fields. The ASSETS program, including the summer school and follow-up support the students received in Years 11, 12 and beyond, were highly valued by the alumni and contributed to long-term impacts in several areas:

- increased self-confidence to pursue educational and career aspirations and increased focus on more specific aspirations
- increased connection to culture and increased focus on finding out about cultural heritage
- increased understanding and application of Aboriginal and Torres Strait Islander knowledge in STEM
- larger and stronger peer networks and friendships and a stronger sense of community
- enhanced groupwork project skills
- increased career prospects from cadetships and internships
- increased insight into university and STEM careers
- invaluable ongoing personal and professional support from ASSETS staff and mentors.

We released an evaluation report in mid-2020 for the I^2S^2 program, which found:

- the program led to increased engagement and academic achievement particularly among low-achieving students
- the hands-on, inquiry-based activities incorporating Aboriginal and Torres Strait Islander knowledges were engaging
- the program also led many Aboriginal and/or Torres Strait Islander students to feel more pride, sense of value and belonging
- there was evidence of interest in STEM subjects and careers among I^2S^2 students (and some evidence of better-than-average uptake of STEM subjects in I^2S^2 schools).

Read the evaluation report on our website.



Objective 3:

Manage national research infrastructure for the nation

Our third objective is addressed by a single requirement:

REQUIREMENT	ACHIEVEMENTS	PERFORMANCE MEASURED AND ANALYSIS
3.1 Ensure utilisation of national facilities and collections.	Pages 96–106	Pages 109–110

The outcome expected from this objective:

1. Our world-class facilities and collections are available to be accessed and used effectively by the research community and public.

3.1: Ensure utilisation of national facilities and collections

Our key activities contributed to our strategic focus areas and provided services to the Australian innovation system and industry via:

- Australian Centre for Disease Preparedness
- Australia Telescope National Facility
- Marine National Facility
- Pawsey Supercomputing Centre
- National Research Collections Australia
- Atlas of Living Australia.

We delivered on this function by:

- hosting world-class, science-ready research facilities and biological collections available for use by the national and international science community across government, academia and industry
- advising on the identification of facility needs and the design and creation of new national infrastructure.

We host world-class national research infrastructure on behalf of the Australian Government to provide the scientific community with access to specialist infrastructure to assist in the delivery of research in the national interest. Our national research facilities and biological collections are provided to researchers across Australia and internationally through merit-based assessments. These include landmark research platforms, specialist laboratories, scientific and testing equipment, supercomputers and digital capability, and other specialist research facilities and expertise.

In addition to scientific and applied research, we provide school student and tertiary education programs, practical training, and access to research data and publications. Read more about these programs on page 84. Some of the National Research Facilities and Collections are also available for use through commercial arrangements.

National Facilities and Collections that we manage receive significant CSIRO appropriation. We also receive funding from the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) program, state governments, commonwealth and state departments, and partnership arrangements specific to individual infrastructure.

Strategic development

Advisory committees provide advice on strategic development and access arrangements where appropriate.

In 2020–21, the global COVID-19 pandemic continued to impact our services. The Australian Centre for Disease Preparedness, with its high-level containment (PC4) laboratories and specialist expertise, played a significant national and international role in vaccine testing and providing knowledge about COVID-19. The Pawsey Supercomputing Centre also supported COVID-19 national and international research studies. The Marine National Facility's multidisciplinary ocean Research Vessel *Investigator* ceased seagoing operations during the height of the pandemic. National Research Collections Australia (NRCA), Atlas of Living Australia (ALA) and Australia National Telescope Facility (ATNF) operated with minimal disruptions.

Our newest radio telescope, the Australian Square Kilometre Array Pathfinder (ASKAP), took just 300 hours to complete the largest and most detailed survey of the southern sky ever. Read more about the survey on page 101.

We launched Quasar Satellite Technology to commercialise aspects of ASKAP technology in the satellite communications sector and grow Australia's space and manufacturing capacity. Read more about Quasar Satellite Technology on page 50.

In June this year, the Square Kilometre Array (SKA) Observatory Council approved construction of the SKA telescopes in Western Australia and South Africa. The SKA project will attract an estimated $1.8 billion in foreign income flows into Australia as a result of the Observatory's first 30 years of operations, will create hundreds of new construction and operations jobs and boost Australia's high-tech sectors.

Other new national infrastructure developments included establishing Australia's first quantum-supercomputing hub for innovation at the Pawsey Supercomputing Centre with a quantum computing start-up from the Australian National University. Upgrades also proceeded on the facilities at ACDP and the Pawsey Supercomputer Centre and for the NRCA.

Additional CSIRO research facilities available for use by industry or research partners include the Collaborative Crystallisation Centre, Australia's only full service protein crystallisation facility (Parkville) and our Clayton sites' Lab22 Innovation Centre, FloWorks Centre for Industrial Flow Chemistry and the Recombinant Protein Production Facility; access is available to academic and industrial users through service or collaborative agreements. Clayton's Biomedical Materials Translational Facility helps medtech companies turn new discoveries into market-ready products. It contains much of the equipment needed to develop a product though scale-up, prototyping, pre-clinical testing and industry evaluation.

In Sydney, the Lindfield Collaboration Hub is an innovation incubator that houses some of the most innovative start-ups and SMEs. The Collaboration Hub, supported by the NSW Government's Department of Industry, offers tenant start-ups and SMEs access our facilities and laboratories to develop their ideas. This includes access to a Maker Space, which houses digital and analogue electronics, prototyping, general laboratory equipment and small-scale workshop tools. Read more about our research facilities on page 138.

Clayton's Biomedical Materials Translational Facility helps medtech companies turn new discoveries into market-ready products.

The FloWorks Centre for Industry Flow Chemistry is available for industry and research bodies to partner and develop flow chemistry processes.

Australian Centre for Disease Preparedness

The Australian Centre for Disease Preparedness (ACDP) is a purpose-built, high-biosecurity facility that helps to protect the nation's livestock and aquaculture biosecurity, and the health and wellbeing of our people, from exotic and emerging infectious diseases. We facilitate impactful research of national benefit through collaborative access to our world-leading infrastructure by international academics, government agencies, research organisations and industry. Together, we maintain and develop core capabilities to address all aspects of infectious disease preparedness: awareness, assessment, mitigation and response.

We manage and maintain infrastructure to support the Department of Education, Skills and Employment. This allows Australian and international researchers to access the highest-level containment (PC4) laboratories and the PC3 immunology laboratory, PC3 bioimaging suite and PC3 insectary. ACDP recently established a new electron microscopy facility, which adds to our world-class infrastructure that is available to infectious disease researchers.

In 2020–21, we provided diagnostic, surveillance, preparedness, prevention and outbreak response capabilities to support the Department of Agriculture, Water and the Environment (DAWE) and DFAT. These activities enhance biosafety in the Asian region and mitigate threats to Australia's trade and market competitiveness by researching the diseases that threaten Australia's livestock and aquaculture industries and the nation's public health.

ACDP hosted World Organisation for Animal Health (OIE) Reference Laboratory designations for several diseases and maintained 3 Collaborating Centre designations. This year, to build on our reputation as a centre of excellence, our reference laboratory credentials expanded to include Reference Laboratory designations for African swine fever and classical swine fever. We operated an international prevention program for regional countries to build regional biosecurity capabilities through ongoing education. This ensures we have effective pre-border surveillance and can promptly detect and investigate emerging infectious diseases in our region.

ACDP played a key role in Australia's response to COVID-19. We undertook pre-clinical vaccine candidate testing in an animal model for the Coalition for Epidemic Preparedness Innovations (CEPI) and performed virus survivability testing in our secure facilities.

Throughout 2020–21, we responded to other disease outbreaks in Australia. ACDP confirmed the first detections of *Ehrlichia canis*, a bacterium never detected in Australia that causes disease in dogs. This led to an ongoing surveillance program with a view to eradication. We also responded to an outbreak of avian influenza virus in the poultry industry that affected chicken, turkey and emu farms. Our response helped to contain the disease, which allowed these industries to resume trade. We continued to monitor for white spot disease in prawn farms following the first outbreak of this disease in Australia in 2016.

To understand how diseases emerge, we draw upon expertise from across our organisation to understand how humans, animals and environments interconnect. We continued to promote and develop a vision for a multisectoral, one-health approach to disease research involving all 3 sectors of veterinary, human and environmental health by collaborating with research institutes, universities, science networks and industry. In November, ACDP hosted a World One-Health Day virtual symposium for the 3 Geelong Centre for Emerging Infectious Diseases partners (ACDP, Barwon Health Research and Deakin University), to promote the benefits of a one-health transdisciplinary approach to solve today's critical animal, human and ecological health challenges.

Our scientists at ACDP were in high demand. They received over 87 SARS-CoV-2 enquiries for access and research collaborations in diagnostics, antiviral therapeutics, vaccine development and inactivation/disinfection studies.

A $200+ million upgrade of the high-biocontainment facilities is in the detailed planning phase. The project will ensure the facility continues to meet current and emerging regulatory compliance standards and is fit-for-purpose now and into the future. As part of the upgrade, we are engaging with Australian academia and industry to develop and unify the nation's sovereign capability in disease preparedness.

Supporting the response to Victoria's avian influenza outbreak

In July and August, 3 different strains of avian influenza were detected across 6 commercial production farms in Victoria. The properties included 4 poultry farms near Lethbridge, one near Bairnsdale and one emu farm near Kerang.

The 3 different strains were: highly pathogenic H7N7 avian influenza in 3 chicken egg farms; low pathogenic H5N2 avian influenza in 2 turkey farms; and low pathogenic H7N6 avian influenza in one emu farm.

Avian influenza, commonly referred to as 'bird flu', is a highly contagious viral infection of birds. Suspected outbreaks of bird flu require a rapid response to protect an industry that contributes $1.8 billion to Australia's economy.

Staff at our Australian Centre for Disease Preparedness quickly tested samples from affected properties to confirm and characterise the outbreak strains. This work was complemented by further testing at AgriBio.

Not only did these events include the largest highly pathogenic bird flu outbreak ever recorded in Victoria, but it was also unusual to see 3 strains, both highly and low pathogenic, occurring at the same time.

We conducted in total over 3,400 tests during the outbreak, including ongoing testing to ensure bird flu was no longer present at the affected properties. Our genetic sequencing confirmed the H7N7 strain was present at the 3 affected egg farms in this outbreak, and this work informed the specific response at these farms.

Our work helped quickly bring the bird flu outbreak under control. Credit: Flickr, A. Terracini CC BY SA-2.0.

ACDP experts attended meetings of the Consultative Committee on Emergency Animal Disease (CCEAD) to present findings and to provide ongoing disease consultancy for the outbreak.

Our work continues with several ongoing studies to assess the pathology and virulence of the newly emerging H7N7 and H7N6 virus strains, plus virus genome sequencing to better understand the different virus strains involved.

We are also determining how the H7N7 virus spread between the commercial farms. In collaboration with the Bureau of Meteorology and Victorian Department of Jobs, Precincts and Regions, we used wind dispersion modelling to show this might have occurred through carriage of the virus on dust particles and are currently using genome sequencing to confirm this.

Rapid delivery of results and advice to Victoria's Chief Veterinary Officer (CVO) allowed for development of an informed control plan to curb the spread of bird flu throughout regional poultry industries.

Meanwhile, the H7N6 strain was the first bird flu outbreak of farmed emus in Australia. Our team worked closely with the Victorian CVO and response agencies to assess the risk of the outbreak and the future of the emu egg and breeding industry.

Determining the pathogenicity of the virus infecting the emu farm was not straightforward. One of ACDP's most important contributions was to propose and carry out a pathogenicity test of the virus infecting the emus. The results of this study were pivotal in informing the CCEAD on the best post-outbreak strategy towards declaration of freedom from disease. Through our diagnostic, genetic and pathogenicity testing, analyses and advice, the team at ACDP helped to save Australia's emu industry and brought the outbreaks under control.

Avian influenza has now been successfully eradicated from all 6 affected farms. A program of sampling, testing and surveillance at these farms has provided evidence that the bird flu virus is no longer present.

In February, Australia officially regained freedom from highly pathogenic bird flu in accordance with international guidelines published by the World Organisation for Animal Health.

Australia Telescope National Facility

This year marked the 75th anniversary of the first radio astronomy observation in Australia – when our researchers observed the Sun using World War II radar equipment at Collaroy Plateau, Sydney. Now, the Parkes radio telescope, the Australia Telescope Compact Array (ATCA) and the Australian Square Kilometre Array Pathfinder (ASKAP) – collectively the Australia Telescope National Facility (ATNF) – are used by astronomers around the world to improve our understanding of the Universe.

This year, we received more than 248 proposals to use Parkes and ATCA, and 8 large research teams from Australia and overseas used ASKAP. In addition, 113 papers were published in refereed journals using data from our telescopes, including the largest and most detailed survey of the southern sky that revealed 3 million galaxies – including one million never seen before. The Rapid ASKAP Continuum Survey took just 300 hours' observing where previous surveys have taken years.

We launched a company, Quasar Satellite Technology, to commercialise aspects of ASKAP technology in the satellite communications sector and to grow Australia's space sector and manufacturing capacity. Read more about Quasar Satellite Technology on page 50.

Square Kilometre Array Treaty

This year, the Square Kilometre Array (SKA) Treaty came into force, the SKA Observatory was formed and construction of the international SKA telescope was formally authorised. The SKA will be built on our Murchison Radio-astronomy Observatory (MRO), the world's premier radio quiet site and home to ASKAP. We operate the MRO on behalf of the nation and will operate the SKA telescope in partnership with the SKA Observatory.

We also operate the European Space Agency's tracking station at New Norcia near Perth, and the National Aeronautics and Space Administration's (NASA) Canberra Deep Space Communication Complex (CDSCC). In addition, we manage Australian astronomers' access to the CDSCC antennas, including pairing the ability of CDSCC antennas to transmit with the receivers on ATNF telescopes to track asteroids passing close by Earth.

ATNF telescopes have long provided ground station support for NASA's lunar missions. United States aerospace company, Intuitive Machines, will become one of the first commercial companies to carry NASA payloads to the Moon, and it purchased time on Parkes to gather data from its spacecraft.

Our Parkes radio telescope was listed on the national heritage register and given the name 'Murriyang' by the Wiradjuri traditional owners. Murriyang is the skyworld where a Wiradjuri creator spirit lives (also known as the constellation Orion). Read more about the heritage listing on page 128.

We acknowledge the Wajarri Yamatji as the Traditional Owners of the MRO site.

Our work with the Australian Space Agency

We provide technical advice to the Australian Space Agency on the development of the Australian civil space sector to further the Agency's aims. Our significant R&D in space technologies and applications and leading international technical engagement help us to identify opportunities to work with industry and research organisations to grow Australia's space markets.

This year, we contributed to the 2020 Bushfire Earth Observation Taskforce led by the Australian Space Agency with Geoscience Australia and the Bureau of Meteorology, and to the national Earth Observation from Space Roadmap led by the Australian Space Agency. We also contributed expertise to the development of the Agency's other national space technology roadmaps.

We are a member of the International Space Exploration Coordination Group and International Mars Exploration Working Group in partnership with the Australian Space Agency. Our fifth Space 2.0 workshop was held in conjunction with the Australian Space Agency with a focus on manufacturing. This series of workshops supports opportunities for Australian space start-ups and SMEs to develop research and business collaborations with CSIRO, the research sector, aerospace primes, and space technology end-users. In partnership with the Australian Space Agency, we also deliver NASA's Global Learning and Observations to Benefit the Environment education program for school students and teachers.

ASKAP creates new atlas of the Universe

Our newest radio telescope conducted its first survey of the entire southern sky in record speed and detail, creating a new atlas of the Universe.

Using the ASKAP telescope at our Murchison Radio-astronomy Observatory in outback Western Australia, researchers mapped approximately 3 million galaxies – including about a million never seen before – in just 300 hours.

The telescope's key feature is its wide field of view, generated by receivers we designed using phased array feed technology that enables ASKAP to take panoramic pictures of the sky in amazing detail.

The Rapid ASKAP Continuum Survey team only needed to combine 903 images to observe 83 per cent of the entire sky, significantly less than the tens of thousands of images needed for earlier all-sky radio surveys conducted by major world telescopes.

This record-breaking result demonstrated that a detailed all-sky survey could be done in weeks rather than years.

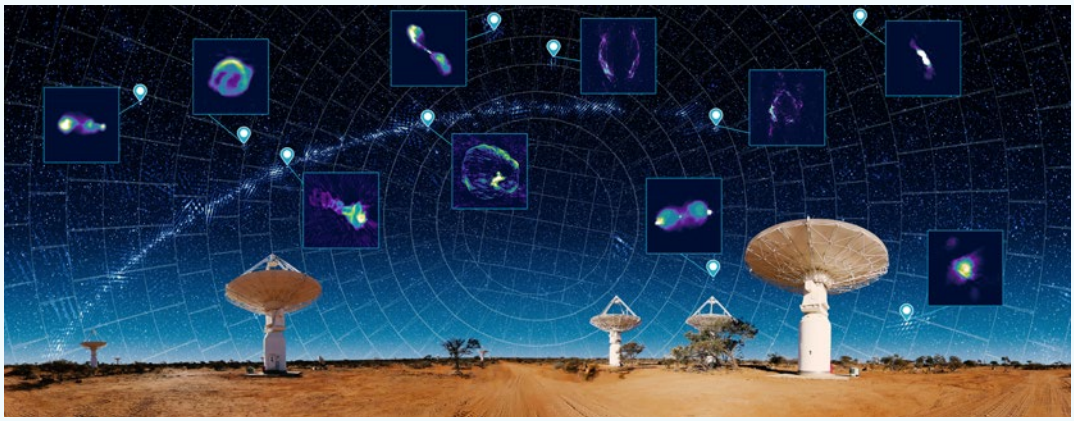
The new data will enable astronomers to undertake statistical analyses of large populations of galaxies, in the same way social researchers use information from a national census. This census will be used by astronomers around the world to explore the unknown and study everything from star formation to how galaxies and their super-massive black holes evolve and interact.

We expect to find tens of millions of new galaxies in future surveys using ASKAP.

The 13.5 exabytes of raw data generated were processed using custom-built hardware and software. The Pawsey Supercomputing Centre's 'Galaxy' supercomputer converted the data into 2D radio images containing a total of 70 billion pixels.

The final 903 images and catalogues from the survey amounted to 26 terabytes of data and are publicly available through the CSIRO Data Access Portal and hosted at Pawsey.

ASKAP's advanced technologies are also providing insights for the development of the Square Kilometre Array.



Astronomers using our ASKAP telescope have mapped about a million previously undiscovered galaxies in the most detailed survey of the southern sky ever carried out using radio waves.

Marine National Facility

The Marine National Facility (MNF) provides Australian researchers and international collaborators with world-class research capabilities throughout Australia's largely unexplored marine estate and adjoining waters. The MNF supports government, industry and other stakeholders to make evidence-based decisions to enhance the long-term viability and prosperity of the marine environment, industries and communities.

All of Research Vessel *Investigator's* voyages that were cancelled due to COVID-19 were rescheduled. In July, voyages recommenced under COVID-safe operations, and 293 sea days were delivered without further disruption.

Nine voyages were completed comprising 7 primary, one transit and one technical voyage (including the charter voyage). When seagoing operations were suspended due to COVID-19, the ship acquired atmospheric data while the vessel was docked in Hobart.

Research Vessel *Investigator* commenced a voyage to assess biodiversity in Australia's Indian Ocean Territories.

This year MNF enabled collaborative research that:

- maintained the Southern Ocean Time Series array, which gathers information for the Integrated Marine Observing System for climate, carbon and ocean health
- investigated the Australian-Pacific plate boundary at the Macquarie Ridge
- mapped the bathymetry and benthic habitat of the Huon Marine Park and contributed to bathymetric models of Storm Bay
- explored carbon sequestration in subpolar and polar waters
- quantified krill abundance for krill monitoring and management of the Australian Antarctic Territory
- maintained the East Australian Current mooring array located off Brisbane, which forms part of the Integrated Marine Observing System
- increased our understanding of how Australia and Antarctica separated
- investigated microplastics in the food chain
- commenced a voyage to assess biodiversity in Australia's Indian Ocean Territories
- contributed to global atmospheric, meteorological, oceanographic and seafloor mapping data sets, including the Global Ocean Observing System array of time series observations, Global Temperature and Salinity Profile Programme, and the AusSeabed mapping network.

The MNF revised its processes for sea time applications to broaden access to the facility. One stream of access – aimed at bringing together researchers and government end-users to develop science that addresses government policy priorities – attracted 6 co-designed applications for time at sea.

Quantifying Antarctic krill to inform sustainable fisheries management

In January, Research Vessel (RV) *Investigator* departed on a two-month voyage to waters off the coast of Mawson research station in East Antarctica to study a keystone species in the Antarctic ecosystem, Antarctic krill.

The primary objective of the voyage was to generate reliable krill biomass estimates for the region. These will be used by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to set precautionary catch limits for krill in waters off East Antarctica, where a commercial fishery is being re-established.

With changes in technology increasing fishing efficiency and impacts from climate change, meaning vessels can now fish longer and in new areas, it is vital that high-quality data is available to inform marine resource and fisheries managers and policy makers.

Led by the Australian Antarctic Division, this record-breaking voyage capitalised on both the endurance and extensive research capabilities of RV *Investigator*. It saw the ship go further south and further west than ever before. Scientists used the advanced acoustic systems (echosounders) on board the ship, as well as a range of other ship systems and novel technologies, to measure krill populations in Antarctic waters.

Significantly, for the first time, we conducted surveys to examine krill biomass in the deep ocean down to abyssal depths. These surveys used deep-sea moorings, with a deep-sea camera and light trap, and water sampling from near the sea floor to search for the DNA signature of krill. The data collected will greatly increase our understanding of the importance of this deep-sea habitat to krill.

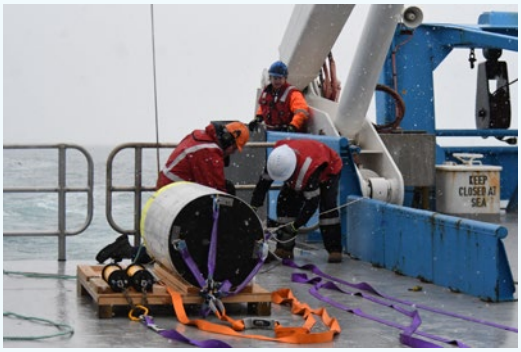
We also made observations of Antarctic predators, such as seabirds, seals and whales, to examine the relationship between predators and krill distribution and density.

These studies increased our understanding of the relationship between krill and predators. This will help fully inform the setting of the precautionary catch limit by CCAMLR. The research will also contribute towards the design of a practical, long-term ecosystem monitoring program that accounts for predators and prey, and the impacts of climate change and any future krill fishery.

The data collected will provide a more reliable and complete biomass estimate for Antarctic krill in the East Antarctic region.

This estimate will allow CCAMLR to set a precautionary catch limit for the region. This will help ensure that commercial fishing activities leave enough krill for Antarctic predators and healthy ecosystem function to support the prosperity of our growing blue economy.

Dr Maddie Brasier, University of Tasmania, preparing krill trawl equipment on RV *Investigator*. Credit: So Kawaguchi, Australian Antarctic Division.



Preparing an acoustic mooring for deployment from RV *Investigator*. Credit: Olivia Johnston, University of Tasmania.

Pawsey Supercomputing Centre

Named after Australian scientist, Joseph Pawsey, known as one of the pioneers of Australian radio astronomy, the Pawsey Supercomputing Centre is one of two national high-performance computing (HPC) and data facilities in Australia. It is an unincorporated joint venture we have with 4 Western Australian universities: Curtin University, Edith Cowan University, Murdoch University and the University of Western Australia. We own, manage and operate the facility on behalf of the partners, and the facility is available to all Australian researchers through a peer review mechanism run by Pawsey.

The Centre provides world-class infrastructure and expertise in supercomputing, data and visualisation services. This enables Australia's researchers to solve large-scale data problems and obtain critical knowledge into the challenges facing our nation, to contribute to globally important research.

In 2020–21, Pawsey enabled researchers to develop new ways to breed plants resistant to extreme weather conditions; create cleaner methods of air travel using high-fidelity simulation approaches; develop improved diagnostic tests for coronaviruses; complete the broadest search at low frequencies for alien technologies; and protect Australian mammal species by mapping genomes, including the koala and the quokka.

In partnership with Western Australia Data Science Innovation Hub and with the support of Federal and State Government, the Centre established the Australian Space Data Analysis Facility. This facility will support researchers and small- to medium-sized enterprises with space data analytics and expertise.

With the impacts of COVID-19, we rapidly transitioned to online and virtual training and engagement and support programs to ensure we remained connected with our research community.

Pawsey and the ANU Canberra-based National Computational Infrastructure (NCI) supported the national and international research community to acquire, analyse and share COVID-19 research information through computation and data resources. This research contributed to the global effort to understand and overcome COVID-19.

As part of the Australian HPC COVID-19 accelerated access initiatives, 8 research groups received prioritised and expedited access to computation and data resources. At the 2 national tier-1 supercomputing facilities, we collaborated on shared workflows, virus' lineage, statistical inferences about potential treatment outcomes, COVID-19 targets and molecular modelling to help fight the pandemic.

As a result of this collaboration, Pawsey and NCI joined the US-led COVID-19 HPC Consortium. The Consortium is a unique private-public effort spearheaded by the White House Office of Science and Technology Policy, the United States Department of Energy and IBM to bring together government, industry and academic leaders who are volunteering free compute time and resources on their world-class machines.

In addition, Pawsey joined forces with an Australian quantum computing start-up from the Australian National University to develop Australia's first quantum-supercomputing hub for innovation. As part of Pawsey's Quantum Pioneer Program, Pawsey will host and make available a quantum emulator to industry leaders and researchers. It will develop cutting-edge quantum applications in machine learning, logistics, defence, aerospace, quantum finance and quantum research.

As research develops, the need for more computer power is growing exponentially. To ensure Pawsey remains a cutting-edge supercomputing facility, a $70 million upgrade of its infrastructure is proceeding. This year, Pawsey announced its new flagship system architecture, Setonix, which is built around the same architecture used in world-leading exascale supercomputer projects. The new supercomputer will deliver up to 50 petaFLOPs, or 30 times more compute power than its predecessor systems, Magnus and Galaxy.

Pawsey joined forces with an Australian quantum computing start-up from the Australian National University to develop Australia's first quantum-supercomputing hub for innovation.

Simulating atoms for green energy

The ongoing effects of climate change and international emission reduction targets have led to a global focus on green materials.

In 2020, an estimated 24 per cent of Australia's total electricity generation came from renewables (DISER (2021) Australian Energy Statistics, Table O). Within the next 2 decades, almost every Australian state and territory is planning to have most of its power generation through renewables.

Pawsey has been working with a Griffith University chemical sciences team in Queensland to find new materials for solar cell and hydrogen production. By understanding the physical properties of different molecules, we can cut the cost of solar cells and hydrogen gas generation.

The team simulated the atomic action of quantum dots. These are man-made semiconductor crystals used in the world's most efficient solar cells. The aim of the simulation is to understand exactly how quantum dots behave when sunlight hits them.

Understanding the properties of quantum dots means simulating the probabilistic nature of nanoparticles, 1,000 times smaller than the width of your fingernail. This requires enormous computing power.

The team was able to model the power conversion of quantum dots in solar cells, finding their power conversion efficiency was 16.6 per cent, a record in the quantum dot solar cell industry.

The team is now exploring safer, lead-free alternatives for solar cells. Currently, quantum dot solar cells need lead, a toxic metal that can leach into the environment, contaminating earth and water.

Meanwhile, platinum is used as a catalyst in hydrogen production. Its costs are at an all-time high of nearly US$1,300 an ounce. This contributes to the high cost of green energy.

The team's quantum simulation techniques are finding low-cost, Earth-abundant alternatives, like nickel. This could work as a cheaper catalyst when surrounded by a metal organic framework.

These catalysts could contribute to cheaper, more environmentally friendly solar cells. It contributes to our roadmap on low emissions, set to exceed our emissions reduction target for 2030, using solar as a new energy generation source.

New materials research is vital to building Australia's green energy economy. Our industry partnerships empower researchers to perform this fundamental research, which goes on to make a huge impact in our energy market.

Researchers using the Pawsey supercomputer have revealed the working principles of the quantum dot solar cell with world-record energy conversion efficiency.

National Research Collections Australia and the Atlas of Living Australia

The National Research Collections Australia (NRCA) is the most taxonomically and geographically comprehensive specimen-based representation of Australia's unique natural heritage. It comprises 6 national collections of insects, plants, fish, wildlife, algae and tree seeds. The collections contain over 15 million specimens, tissue samples, sound recordings, images, DNA sequences and environmental data, which document and characterise Australia's diverse and changing environment back to 1770.

To assist the national bushfire recovery effort, our collections provided the government with detailed information on the species most at risk due to habitat loss and identified possible source populations for post-fire re-introduction efforts.

Our collections were explored for bioactive molecules to develop new pharmaceuticals that treat human diseases, as well as for useful molecules for the food industry. NRCA's 2 living specimen collections of algae and tree seed provide Australian industry with reference strains and breeding material. This year, the teams supplied expertise and advice to SMEs and regional partners in developing countries.

As part of the Future Science Platforms program, we extended our work in machine learning to develop artificial intelligence-based identification tools for weeds, insect pests and toxic algae. We also explored opportunities to develop AI-assisted curation and digital trait extraction from collections specimens. We continued to collaborate with industry partners to build high-throughput genotyping platforms for environmental monitoring.

We commenced automated digitisation of the 1.2 million specimens in the National Herbarium and continued the digitisation and genetic sequencing of the 20,000 type specimens in the insect collection, which is providing important reference data for eDNA-based environmental monitoring. In addition, we began to incorporate Indigenous species names into our data systems.

The concept design phase of new accommodation for our 4 Canberra-based collections, slated to open in 2024 on our Black Mountain site, was also completed. The accommodation will consist of state-of-the-art archival collection halls and research and digitisation laboratories, which will protect and enhance the ongoing use of this important research infrastructure.

The Atlas of Living Australia (ALA), funded through NCRIS, is our online national biodiversity data infrastructure that makes the digital data in our research collections (NRCA) and from other Australian bio-collections available for open access use.

It provides a collaborative and open digital platform that harmonises Australian biodiversity data, making it accessible and re-useable. It is a critical tool for biodiversity scientists, policy makers, land managers, educators and students and provides the Australian node of the Global Biodiversity Information Facility, ensuring Australia's biodiversity data are accessible to the world.

In 2020–21, the ALA delivered over 95 million biodiversity occurrence records to over 90,000 registered users to support innovative science. The ALA team and infrastructure supported a number of major national biodiversity-focused programs, including our citizen science response to the 2019–20 summer bushfires, and the development of a biosecurity alert capability to support the Department of Agriculture, Water and the Environment's Office of the Chief Environmental Biosecurity Officer. ALA also released the ALA online bibliography. Read more about citizen science on page 19.

In October, the ALA celebrated 10 years of operation, which involved a national communication campaign and international science-impact webinars.

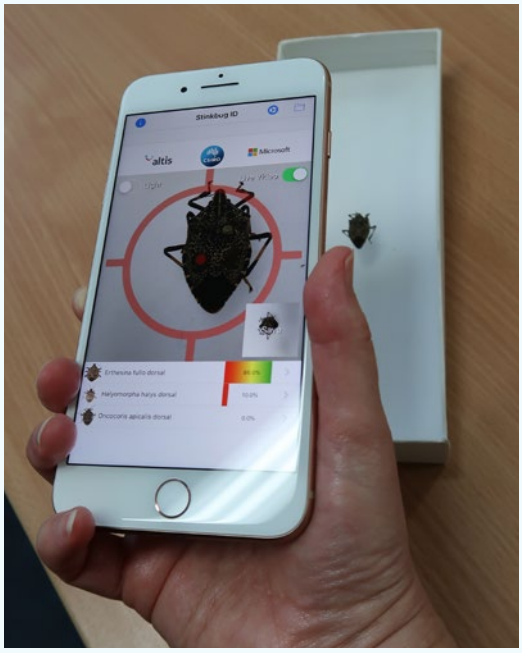
AI-based identification tools for stink bug biosecurity

The Brown Marmorated Stink Bug (*Halyomorpha halys*) is a National Priority Plant Pest. Native to eastern Asia, during the past 2 decades it has become established in North America, Europe, Western Asia and South America. It poses a major threat to Australian agriculture due to its wide plant host range and the damage it causes to vegetable crops, fruit trees and ornamental trees.

Essential for biosecurity

Early and accurate detection of Brown Marmorated Stink Bug is essential for Australia's biosecurity. This is challenging due to its morphological similarity to local harmless species.

To address this problem, we worked with the Department of Agriculture, Water and the Environment to create a species identification tool. This tool uses AI and computer vision to provide fast, accurate recognition of stink bugs. It builds on a prototype image recognition app for identifying weed seeds that we co-developed with Microsoft in 2018.



Using our app to identify a stink bug.

Australian National Insect Collection

We included 9 priority stink bug species in our identification tool, including Brown Marmorated Stink Bug, 3 other exotic pests and 5 harmless Australian native species that resemble exotic pests. We used more than 200 stink bug specimens held in our Australian National Insect Collection and an additional 500 specimens loaned from other collections. We expertly identified each specimen and produced a library of high-resolution photos at multiple focal points. We then trained Microsoft's Custom Vision AI model to recognise dorsal (top) and ventral (underside) views of the 9 priority stink bug species.

Model testing in the app format demonstrated the ability of the approach to differentiate stink bug species and to identify Brown Marmorated Stink Bug correctly. Most misidentifications involved 2 Australian native species that look very similar. In real world situations, identifications are likely to be highly accurate because the app provides illustrated species profiles for users to cross-check and correct any potential identification errors.

Our work provides a low cost, automated, portable solution to identify brown marmorated stink bugs by non-expert biosecurity officers. It uses AI and machine learning techniques to mobilise specimens and knowledge held in NRCA to address a national biosecurity problem.

Our future work with the app will focus on assessing user experience, adding the functionality to upload observation records to a central database, and additional stink bug species of biosecurity relevance.

ALA helps stop pests in their tracks

Keeping track of environmental pests and weeds is an ongoing challenge. The Department of Agriculture, Water and the Environment's (DAWE) Chief Environmental Biosecurity Officer is charged with protecting our native flora, fauna and crops that underpin Australia's aquaculture and agricultural industries.

The biggest challenge for DAWE is knowing when pests and diseases first come into Australia and keeping track of their spread across the country. Early detection of pest species is crucial; however, pests, weeds and diseases sometimes elude our stringent border controls and quarantine measures.

ALA, in partnership with the Chief Environmental Biosecurity Officer, is harnessing innovative solutions in biodiversity data aggregation to address this challenge. This work complements existing methods of detecting invasive species and boosts DAWE's biosecurity surveillance capability.

For over 10 years, the ALA has been aggregating occurrence records of plant, animals and fungi species from a wide range of data partners. In 2020, the ALA collaborated with DAWE to establish an automatic email alert system for target pest species based on a list of species considered biosecurity threats to Australia. Now, when observations of target species are uploaded to the ALA, an alert is sent straight to the Chief Environmental Biosecurity Officer.

The biosecurity data alert system has already delivered impact and results. In late 2020, there were 2 suspected sightings of the Asian Shore Crab (*Hemigrapsus sangineus)* by members of the public on Port Phillip Bay beaches in Victoria. This species has the potential to become a major pest. If left unchecked, it could spread rapidly and compete with our native crabs and shellfish, including scallops, mussels and oysters. It could also spread disease to native prawns, crabs and lobsters. The alert system allows for early sightings, or even suspected sightings, of pest species to be sent straight to DAWE.

The Asian Shore Crab is on Australia's biosecurity watchlist and was detected in Victoria in 2020. Credit: This image was taken in the USA and uploaded to iNaturalist by Jeff Holmes (CC-BY-4.0).

Biodiversity data from federal and state governments, museum and herbarium collections, research programs, industry and citizen science apps, such as iNaturalist Australia, feed data into the ALA and directly contribute to the national biosecurity surveillance system.

'The ALA alert system is simple and is proving a pivotal asset to our operational capability. It is a layer of defence we haven't had before.' Andrew Pearce, Acting Director, Chief Environmental Biosecurity Office.

The national biosecurity alert system is an excellent example of how the ALA provides trusted biodiversity data to decision makers and government program managers to help deliver better outcomes for Australian ecosystems.

We are harnessing innovative solutions in biodiversity data aggregation.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcome (see Table 3.13):

- World-class facilities and collections are available to be accessed and used effectively by the research community and public.

Table 3.13: Summary of our performance for managing national research infrastructure

PERFORMANCE MEASURES SOURCE: 2020–21 CORPORATE PLAN	TARGET	RESULT
World-class facilities and collections are made available for access by the research community and used effectively		
ACDP: Compliance with Australian legislation and regulations and International Organization for Standardization accreditations	Maintain or exceed compliance	**Achieved**: Up to date and compliant with all current audits[3]
Facilities and collections achieve a threshold rate of successful usage, with lost time minimised	Achieve or exceed usage rates: (Source: 2020–21 Portfolio Budget Statement)	Results for each facility detailed below
ATNF: successful astronomical observation[4]	Minimum of 70% successful astronomical observations	**Achieved**: 76%
ATNF: time lost during astronomical observations and operation[4]	Maximum 5% time lost during scheduled astronomical observations	**Achieved**: 2.3%
Pawsey: supercomputer core-hour use[5]	90% core hours on supercomputer facility	**Achieved**: 98.4% utilisation
NRCA: outward loans of collection[6]	70% outward loans of collections (averaged over 5 years)	**Achieved**: >70%
MNF: successful marine research days delivered[7]	Minimum of 90% successful research days delivered on Marine National Facilities, subject to any COVID-19 restrictions	**Achieved**: 98%

3 ACDP successfully complied with PC2, PC3 and PC4 requirements of the Department of Health and the OGTR requirements of the Department of Agriculture. ACDP achieved recertification to ISO 14001, ISO 9001, ISO 17025 and ISO 17043 during the year.
4 ATNF data is for April–September 2020 and October 2020 – March 2021 observing semesters for Parkes and ACTA.
5 Supercomputer core-hour use represents the percentage of core hours available of the Pawsey Cray XC-40 supercomputer Magnus that are used by research projects awarded an allocation on Magnus during 2020–21.
6 NRCA outward loans target recognises that preparing loans requires significant time investment and some requests may not be possible to comply with international conventions and legislation.
7 MNF research days recognises the percentage of the planned scheduled that was successfully delivered meeting the stated voyage objectives.

Australian Centre for Disease Preparedness

ACDP repeatedly demonstrated its vital role in Australia's biosecurity infrastructure. Together with our partners, our people worked tirelessly to protect Australia's livestock and aquaculture industries and the community from exotic and emerging infectious diseases, particularly COVID-19. ACDP maintained or exceeded the regulatory requirements certified by the Department of Agriculture, Water and the Environment, the Office of the Gene Technology Regulator, the Department of Health's Security Sensitive Biological Agents legislation and all relevant International Organization for Standardization accreditation. This is critical to enable ACDP to provide the nation's frontline, high-containment facility for research into highly infectious agents in the world, biosecurity, and protecting Australia's multi-billion-dollar livestock and aquaculture industries.

Australia Telescope National Facility

The ATNF maintained its excellent standard for observing performance. ATCA and Parkes achieved similar results to previous years. Our newest radio telescope, ASKAP, achieved its KPI of 40 per cent of time being used for successful astronomy observations. This enabled high-impact science to continue with astronomers around the world, improving our knowledge of the Universe by investigating the formation and evolution of galaxies, magnetic fields, black holes and pulsars.

Pawsey Supercomputing Centre

The Pawsey Supercomputing Centre maintained its track record of exceeding its utilisation target with 98.4 per cent of available central processing unit time used this year. This level of utilisation enables our researchers to successfully deliver their research for the betterment of the nation.

National Research Collections Australia and the Atlas of Living Australia

The National Research Collections Australia continued to meet the target for outward loans, enabling scientists affiliated with research institutions to access our specimens without travelling to our sites. Specimens are lent to other national and international institutions to support research into Australia's unique biodiversity. The Collections help researchers deliver their research as well as contribute to national and international conservation of biodiversity.

Marine National Facility

In 2020–21, RV *Investigator* delivered 293 sea days, a significant achievement given that many research vessels around the world were unable to recommence operations due to the pandemic. Research conducted provided key information to government, industry and other stakeholders to support decision-making related to fisheries management, geological resources, regional and global climate, and marine operations.

The impact of the 2019–20 megafires on Australian vegetation

During the 2019–20 'Black Summer' bushfire season, a series of major fires burnt along the coasts and ranges of south-eastern Australia. The fires severely impacted hundreds of native plant species. Many of the fires occurred in ecosystems that make up a globally significant biodiversity hotspot.

We used satellite hotspot data to map the scale of the fires and herbarium records to determine the most affected plant species.

In total, the fires burned more than 7 million hectares of eucalypt forests and woodlands and more than 300,000 hectares of rainforest. The scale of the fires and the number of plant species impacted was unprecedented for the region.

More than 800 native plant species had more than half of their populations burned, with some experiencing fire across their entire ranges. Many widespread species were among those severely impacted. More than three quarters of rainforest communities were burnt in parts of New South Wales. These contain many ancient Gondwanan plant lineages that are only found in small, fragmented populations.

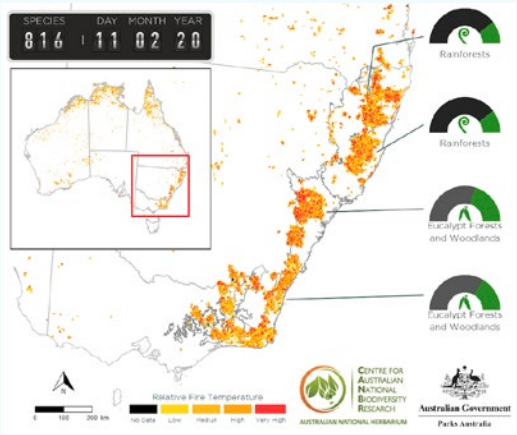
We examined the bushfire recovery traits of more than 200 plant species and found that approximately 90 per cent of these, including many rare species, are resilient to fire. This means their prospects for recovery appear to be good. However, several key plant groups are more sensitive to fire and are now at increased risk of population decline and range contraction. These include 4 epiphytic orchids that appear to have lost much of their host tree habitat, several wind-dispersed bushes that may lack a persistent seedbank and a small group of terrestrial orchids that are sensitive to hot seasonal fires.

We also identified close to 50 severely fire-affected rainforest or rainforest margin species, including several remnant Gondwanan taxa, that are thought to decline under increasing fire regimes. Recovering populations of these species may need additional assistance to prevent adverse impacts of disease, grazing by feral animals, drought and other disturbances. Unburned areas containing these and other fire-affected plant species are scattered across the landscape and now take on added importance for conservation.

Our biogeographic, ecological and taxonomic expertise ensures we are well placed to provide timely high-quality ecological data to assist in planning for, and responding to, extreme climatic and other future catastrophic events.

Implications of the 2019–20 megafires for the biogeography and conservation of Australian vegetation was published in Nature Communications. DOI: 10.1038/s41467-021-21266-5

This work was carried out at the Australian National Herbarium, which is part of The Centre for Australian National Biodiversity Research, a joint venture between Parks Australia's Australian National Botanic Gardens and CSIRO.



This map shows the extent of bushfires over the 2020 season until 11 February 2020. Each map cell is a square 2.5 kilometres along its sides and coloured according to relative fire temperature. Remotely sensed fire hotspot data were drawn from Geoscience Australia's Digital Earth Australia platform. The species counter shows the number of vascular plant species for which more than 50 per cent of south-eastern Australian herbarium specimen records fall within the fires. The dials show the percentage of rainforests burnt in the New England Tablelands (top) and the New South Wales North Coast (bottom) bioregions and eucalypt forests and woodlands burnt in the Sydney Basin (top) and South East Corner (bottom) bioregions over time.

Objective 4:

Ensure the sustainability of CSIRO

Our fourth objective is addressed by 2 requirements:

REQUIREMENT		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
4.1	Ensure a vibrant, safe and positive culture in CSIRO.	Pages 113–120	Pages 120–121
4.2	Ensure CSIRO has sustainable operations, sites and infrastructure.	Pages 122–131	Page 131

The outcomes expected from this objective:

1. Our people are engaged and empowered in their work.
2. Our innovation culture and operations enhance the wellbeing of our people.
3. Our workforce is inclusive, harnessing the full potential of our people.
4. We have efficient and sustainable operations and can move quickly to address opportunities, thus maintaining our capacity to innovate for Australia.

4.1: Ensure a vibrant, safe and positive culture in CSIRO

Our key activities helped us achieve our strategic direction and aspirations:

- Health, Safety and Environment Management Culture and System
- Refreshed culture plan, including wellbeing and values
- CSIRO Workforce strategy including Interchange
- New ways of working.

We delivered on this function by:

- understanding our future workforce needs and ensuring we have the right capabilities (including leadership) at the right time
- supporting our people to thrive and to value their health, safety and wellbeing
- shifting the needle on all elements of our cultural vision and continuing to invest in our leaders
- attracting, developing and retaining the nation's best and brightest to solve complex, emergent challenges for Australia's prosperity into the future.

Our future workforce and leaders

Learning and leadership development: people and digital practices

This year has provided an opportunity to shift our approach to learning and development to focus on growing the capabilities of our people. This involved an extensive review of our established and more traditional learning programs and significant changes to the delivery of our learning services. Simultaneously, we continued to support key learning needs and delivered over 51,000 hours of learning, including the introduction of new programs for virtual facilitation, virtual meetings, and modules tackling key challenges like cyber security, privacy and fraud.

Our Experienced Leader and Ready to Lead programs that support frontline and mid-level leaders were redesigned to be delivered online to build virtual leadership capability and peer connections. Refreshing our leadership capability framework was a key priority for the year and we transitioned to more agile and scalable leadership development approaches aligned with the new framework.

Our Digital Academy – Learning is undergoing significant changes with an increased focus on platforms such as DataCamp, which enabled more than 2,000 hours of learning this year. This shift involves more curated learning pathways to enable role-based digital skill advancement and access to the best technology learning content available.

Succession and talent development

In addition to taking a more transparent, centralised approach to succession planning, we identified a strong pool of successors with readiness in 1–2 and 3–5 years across our executive leadership pipelines.

We are focusing on how to best retain, engage and develop targeted cohorts of high-potential leaders who have the aspiration to lead at an enterprise level in the future, as well as the capacity and commitment to broadly influence and impact our transformation agenda. We are designing an integrated program that accelerates leader development and readiness for key enterprise level roles and contributes to a robust succession pipeline for critical roles.

We're focusing on how to retain, engage and develop targeted cohorts of high-potential leaders.

Our people thrive and value their health, safety and wellbeing

Health, safety and environment

We are committed to ensuring our people thrive and everyone goes home safely, every day.

This is the opening statement from our new Health, Safety and Environmental (HSE) Policy that we launched in July. The Policy underpins our HSE management system, which drives our desired culture through effectively managing HSE risks and delivering effective improvement in our HSE performance. Our management system describes how we will achieve our commitment for working safely, looking out for the safety, health and wellbeing of those around us and minimising our impact on the environment. The system empowers our people by helping them to make informed decisions in their science and in their business. It fosters a positive culture by acting as the mechanism where decisions are informed by an appraised assessment of the HSE risks and opportunities associated with how we conduct our activities and our business.

We continued to roll out accessible HSE tools and resources. In April, we launched our new HSE Resource Hub to support our people and activities with a suite of easily accessible tools, methods and meaningful HSE information. A major feature of these resources will be our HSE digital platform, a project underway to deliver an integrated hazard, incident and risk management and reporting solution. The platform will provide a seamless user experience accessible to all our people – in a laboratory or out in the field – and information analysed to inform risk assessments, safe ways of working and longer-term HSE improvement strategies.

This year, we also focused on reducing our overall HSE risk profile and enhancing preventive control measures through assurance programs that verify and regularly review control measures.

We introduced new specialist roles to directly service our activities and operations in chemical and radiation management, environmental management, ergonomics, occupational hygiene and remotely piloted aircraft operation.

The wellbeing of our people remains a constant focus, particularly given the unprecedented events due to the COVID-19 pandemic. We navigated the risks and swiftly responded to keep our people safe and ensure their health and wellbeing was maintained, especially with most of our people working from home. We offered working from home equipment to almost 4,000 of our people. The working from home package allowed our people to seamlessly transition to being productive and safe at home, no matter where they live in Australia.

We launched a new HSE communication platform that enables us to stay connected in times of need, including sending secure messages about potential emergencies or disruptions to the work environment.

We participated in the Virgin Pulse Global Challenge and in September were awarded Australia's most active organisation. Our people completed over 1.5 billion steps and travelled almost one million kilometres. By the end of the challenge, around 64 per cent of participants exceeded 10,000 steps per day, compared with only 16 per cent at the start. Challenge participants also noticed improvements in nutrition, sleep, concentration and productivity. Over 60 per cent of participants also reported feeling less stressed and noticed positive improvements to their mental, social and physical wellbeing.

In October, we held our annual HS-Me Day, which looked a little different due to the impacts of COVID-19. We came together for a virtual event that included sessions about wellbeing, resilience, sustainably working from home and mindfulness. We continue to maintain our working safely efforts whether at home or onsite, and adapted our people to return to site where we can more personally interact with our fellow colleagues.

Health and safety performance

During the year, we continued to focus on improving our HSE data and our HSE performance. We recorded fewer total recordable injuries compared to last year and our total Recordable Injury Frequency Rate dropped from 5.7 to 3.9 and our Lost Time Injury Frequency Rate dropped from 2.9 to 1.9. Last year, our Serious Lost Time Injury Frequency Rate was reported as 0.21 but was updated to 0.08 after a data review. This metric remained steady this year and only one injury met the definition this year. This metric will be phased out to focus on more leading HSE indicators.

Regulatory notifiable incidents reported to Comcare and other regulators decreased from 16 to 7. These comprised 2 serious injuries, 1 reportable illness and 4 dangerous incidents. All incidents prompted rapid investigation with corrective and preventive actions put into place. We shared HSE alerts and lessons learnt arising from incidents across the organisation.

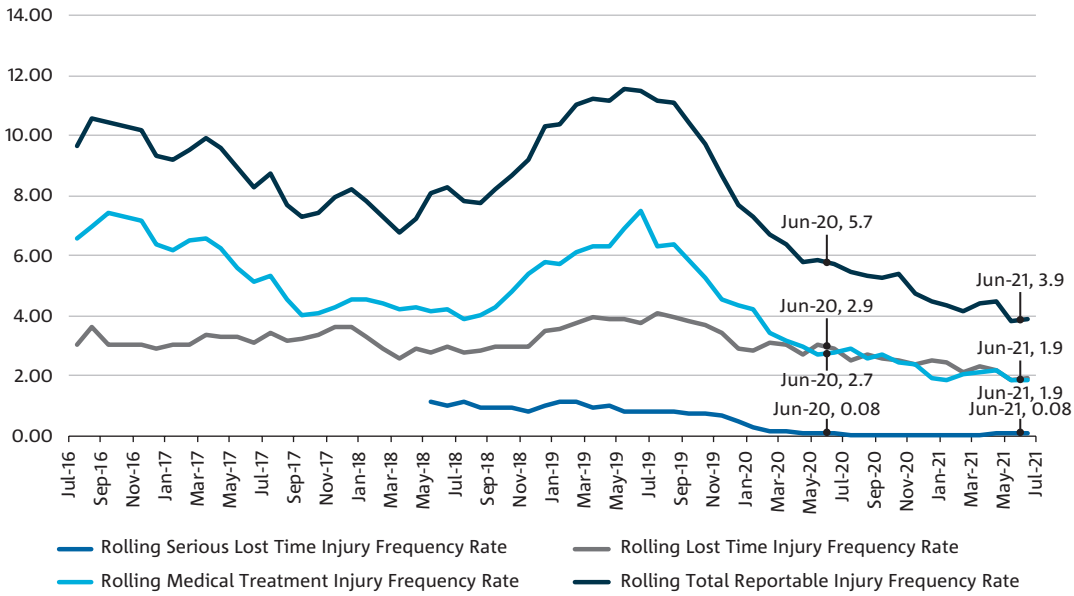
We entered into an Enforceable Undertaking with Comcare as a result of a health and safety incident in 2017, where one of our people was injured but returned to work soon after. At the time of the incident, we issued an immediate stop work across the entire organisation using similar processes to enable a full investigation and time to apply our learnings. This included developing a number of new initiatives we agreed to with Comcare to continue to lift our focus on safety, which we will implement under the Enforceable Undertaking. These include:

- develop and deliver a Virtual and Augmented Reality Risk Management training package that will enable staff to walk through scenarios in the workplace
- expand our risk management processes for all new projects before they start, ensuring that HSE risks are identified and controlled at the earliest possible stage
- develop specialised guidance material for working with high-risk infrastructure in environments that are potentially hazardous due to the materials or equipment present that can be used for all national research facilities in the country.

The full undertaking and general information about our Enforceable Undertaking is available at www.comcare.gov.au.

While our shift to working at home due to the COVID-19 pandemic reduced the number of reported improvement opportunities through our HSE hazard observation and leadership contact program, we continued to actively monitor and review our safety procedures and stay vigilant against complacency. Over 98 per cent (517) of actions arising from hazard observations and our contact program were completed on time.

Figure 3.5: Our recordable injury frequency rates



New criteria applied from July 2019: contractor incidents removed, affiliate hours estimated, new MTI criteria applied.

Staff wellbeing

Despite COVID-19 disruptions, we conducted Pulse surveys in September and March to check in with our people. Our September results showed a drop in some areas of wellbeing compared to earlier in the year, which reflected the sustained effort our people were making to continue to deliver impact during disruptions. In March, we were pleased to see some areas of wellbeing improved, and our people's engagement with the organisation remained strong. Read more about our performance in Table 3.14 on page 120. We continue to focus on supporting our people to work flexibly and are considering further avenues to improve our people's experience by leveraging digital tools to check in with them more regularly.

Our cultural vision

Sustainable engagement

Engagement measures an employee's connection to their organisation and is closely correlated with productivity and performance. In our March Pulse survey, we achieved 80 per cent positive responses to engagement questions, which decreased one per cent below our pre-COVID target of 81 per cent. Our engagement remains high and is equal to pre-COVID levels from 2019 and similar to other Australian organisations.

Organisational values

We addressed the Minister's Statement of Expectations in relation to 'agency staff and health' by placing a greater focus on our organisational values and how these are embedded in our processes, procedures and behaviours. We supported our leadership teams to make the values explicit in how they guide our people and bring the values to life every day. We also empowered our people to localise and personalise the values in their work contexts to ensure the values contribute to delivering our strategic objectives.

We developed a 5-stream Culture Roadmap, which comprises Aspiration, Values, Empowered leaders, Culture in action and Measurement. The Empowered leaders and Culture in action streams will be key enablers of our people, who are our greatest asset. In July, as part of the Values stream, we launched our new values after extensive consultation and co-development with our people: People first, Further together, Making it real and Trusted.

The first priority has been improving awareness of the 4 values and identifying opportunities to explicitly embed them in our systems and processes. We created values champions from our senior leadership team who model and promote ways of bringing the values to life across the organisation.

We will check in with our people in late 2021 to develop a baseline measure of our culture, which will provide insights into what supports our people to succeed or hinders their success.

Diversity, inclusion and belonging

Belonging – the feeling of being valued, welcomed and wanted – is the outcome of tangible inclusive actions and a marker of a truly diverse and inclusive workplace. This year, in recognition of the importance of belonging, we expanded our diversity and inclusion approach to diversity, inclusion and belonging, which will be our beacon of best practice.

Our Diversity, Inclusion and Belonging Strategy 2019–22 focuses on gender, Indigenous Australians, disability and cultural diversity. We are working to continuously improve the inclusivity of our workplace so that all our people can reach their full potential. We do this by seeking to understand the experiences of our people and taking action to ensure our workplace is inclusive and equitable. This helps to deliver on our purpose and drives innovation by leveraging diverse perspectives, networks and experiences from the broadest talent pool to expand our thinking and creativity.

Our 2 major programs to advance gender equity are Science in Australia Gender Equity (SAGE) and the Champions of Change Coalition (previously Male Champions of Change).

Our Chief Executive has been a founding member of the Champions of Change Coalition STEM Group since 2015 and continues to champion decisive action to advance gender equity, complementing the evidence-based, long-term focus of SAGE. Achieving SAGE Bronze accreditation in 2018–19 was a monumental achievement, and we continue to build on this by implementing our 5-year SAGE Bronze Action Plan to address cultural, systemic and pipeline barriers to equity, with a focus on intersectionality and gender. We completed 64 per cent of our SAGE actions and 76 per cent of milestones. Another 31 per cent of our SAGE actions are in progress, reflecting the long-term nature of some of these commitments. We are on the pathway to SAGE Silver and over the next 2 years will focus on deeply understanding our impact to date and developing next steps.

Our people shared stories via a fortnightly 'In the home' series to support each other while working from home in the middle of COVID-19 disruptions, particularly those with caring responsibilities. We also included specific consideration of the impact of COVID-19 and natural disasters in our merit-based promotion applications and encouraged our people to take this mitigation step to support their ongoing career development.

We continued to build on our workplace response to domestic family violence and abuse, acknowledging the implications of our people working from home and the increased frequency and severity of domestic family violence and abuse reported across the world. We provided our people with information and guided our leaders. A motivated network of trained domestic and family violence and abuse contact officers and human resources staff support our people when they need it most.

We embedded our Disability Strategy and formed the Shine@CSIRO network – a group for people with a disability, those caring for family members with a disability, and allies – to improve the accessibility of our systems and frameworks and encourage the inclusion of reasonable accommodations in all that we do.

This year, we also launched our Diversity, Inclusion and Belonging Representative Council, which brings together representatives from across our business areas and diversity networks. The Council will advance our shared purpose; increase communication and collaboration; foster peer-to-peer support, learning and best practice; and embody our organisational values.

Pride@CSIRO

Our Pride@CSIRO network has been instrumental in embedding lesbian, gay, bisexual, transgender, intersex and queer (LGBTIQ+) inclusion throughout our organisation and representing the experiences of LGBTIQ+ people.

We achieved Gold Employer status at the annual LGBTQ Inclusion Awards for the second successive year. The status reflects our outstanding score of 167 out of a possible 200 in the Australian Workplace Equality Index (AWEI), the highest result in our 5 years of participation. AWEI is the only national benchmarking index of its kind. It includes a comprehensive submission process assessed by external assessors and a survey that measures employee opinions on workplace LGBTQ inclusiveness. Feedback from our people also demonstrated that 88 per cent of respondents strongly agreed or agreed that work in this aspect of diversity and inclusion positively influences organisational culture.

Due to COVID-19, we were not able to physically participate in the Sydney Gay and Lesbian Mardi Gras Parade, but we were there in spirit and will participate again when we are able. We delivered our fifth Wear It Purple Day virtually, which focused on the importance of allies to the LGBTIQ+ community.

The Pride@CSIRO network continues to identify and drive systemic changes in procedures and reporting to improve acceptance and comfort within the workplace. We welcomed 38 new members to the network and are planning to pilot our first ever Diversity Month to explore and celebrate the breadth and depth of our people's diversity.

Indigenous engagement

We continued to partner with Aboriginal and Torres Strait Islander communities and organisations to create Indigenous-driven science solutions that support sustainable futures for Indigenous peoples, cultures and the country. We recognise the opportunities for all Australians when we share our knowledge and partner for innovation, and our ongoing collaborations with Aboriginal and Torres Strait Islander communities are helping us to develop innovative solutions to address different environmental challenges.

This year, we partnered with several communities on 13 projects, such as the Indigenous STEM Education Initiatives, which includes the Young Indigenous Women's STEM Academy. Read more about the Young Indigenous Women's STEM Academy on page 89. We collaborated with ranger groups to assess and manage biosecurity risks, launched best practice guidelines on Indigenous-led approaches to strengthen and share knowledge for land and sea management, and hosted national dialogues to tackle climate change challenges.

As part of the Australian Government's National Environmental Science Program's (NESP) Northern Australia Environmental Resources Hub project – and with the support of Microsoft's Artificial Intelligence for Earth program, Aak Puul Ngantam Cape York and Microsoft – we worked with rangers, scientists and Indigenous leaders to develop a world-first AI-infused cloud-based system to manage nest predators and protect turtle populations. By bridging Indigenous knowledge with drone and helicopter-collected photographs, cloud computing and AI, we are protecting endangered sea turtle hatchlings from feral pigs.

In July, we launched Our Knowledge Our Way Guidelines. Over 100 Indigenous individuals and organisations, including partners, co-authors, case-study providers and reviewers, contributed to the guidelines. These are based on 23 case studies that demonstrate best practice and are supported by the North Australian Indigenous Land and Sea Management Alliance and funded by the NESP's Northern Australia Hub.

In March, we collaborated with Traditional Owners as part of the National First People's Gathering on Climate Change. The Gathering was supported by the NESP Earth Systems and Climate Change Hub and provided communities with the tools to respond to climate change-induced events like marine heatwaves, rising sea levels, bushfires and heatwaves.

In June, we presented at the National Australian Institute of Aboriginal and Torres Strait Islander Studies Summit on best practice e-Health technologies for Aboriginal and Torres Strait Islander peoples. We delivered an accurate picture of the needs, issues and aspirations of the native title sector through the largest and most successful survey of Prescribed Bodies Corporate carried out in Australia.

We recognised the need to streamline our science impact programs of work to improve our communication to external Aboriginal and Torres Strait Islander stakeholders. In March, we launched the Indigenous Science portal on our website as a tool to increase awareness and facilitate pathways for future collaboration.

Our Cultural Capability Framework continues to engage our people through meaningful discussions aligned to events that are significant to Aboriginal and Torres Strait Islander peoples, including National Reconciliation Week and NAIDOC Week. At the end of June, 98.9 per cent of our people had completed the online Aboriginal and Torres Strait Islander cultural awareness learning. In February, we launched our face-to-face learning workshops to coincide with the anniversary of the National Apology.

Cultural Protocol initiatives continue to be rolled out across our national sites and digitally. The Acknowledgement of Traditional Owners is included on our new website, 31 of our sites fly the Aboriginal and Torres Strait Islander flags and 22 sites have installed the Acknowledgement of Traditional Owner Plaques.

We sourced our working from home equipment (read more about the working from home package on page 114) from an Indigenous-owned enterprise to show our commitment to supplier diversity. Over the last year, we contributed to the Commonwealth Government's Indigenous Procurement Policy and spent $9,763,890 with Aboriginal and Torres Strait Islander-owned enterprises.

We are working to increase Aboriginal and Torres Strait Islander representation across our strategic advisory groups and governance committees. Indigenous representation on these committees increased; 25 per cent of our committees now have Aboriginal and Torres Strait Islander members.

We continued our commitment to invest and elevate the Indigenous Science Program and transitioned the Office of Indigenous Engagement to the Office of the Chief Scientist. In May, we appointed a new senior Program Director to lead our Indigenous Science and Engagement Team. This role will be responsible for driving equitable partnerships and transformational change by tackling national challenges prioritised by Aboriginal and Torres Strait Islander communities.

Our second Innovate Reconciliation Action Plan finished in May. We remain committed to investing and building mutually beneficial relationships with Aboriginal and Torres Strait Islander communities and stakeholders that we work with, and we are working to renew our plan for another 2 years.

We continued our commitment to invest in and elevate the Indigenous Science Program.

Indigenous employment

We improved our representation of Aboriginal and Torres Strait Islander peoples across the organisation. This year, the number of senior Aboriginal and Torres Strait Islander peoples increased by 12.5 per cent and now comprises 23.4 per cent of all Indigenous staff. Indigenous representation in leadership roles also grew; 3.1 per cent of Executive Manager positions are held by an Aboriginal and/or Torres Strait Islander person. We improved the permanence of our Indigenous workforce with over 70 per cent of Aboriginal and Torres Strait Islander employees holding indefinite positions.

A total of $93,500 in funding was provided to our Aboriginal and Torres Strait Islander Postgraduate Top-Up Scholarships to support 3 students to participate in this program, which was launched in 2016.

At the end of June, 1.47 per cent of our employees identified as Aboriginal or Torres Strait Islander. We recognise there is more work to be done in designing sustainable employment models that facilitate pathways from our entry level programs to ongoing roles across the agency. To address this, we commenced a review of our Indigenous Employment Strategy and created a new role to lead our Indigenous Talent Acquisition Strategy.

Attracting and retaining the best talent

This year, we introduced a new program to increase mobility across the organisation. We tested the Interchange program in 2 rounds where our people could explore a list of current opportunities and register for a short assignment in a different work area. There were opportunities in our Missions program, Future Science Platforms, Enterprise Services and Business Units. We had over 80 per cent success in filling assignments and over 300 people participated in each round across our research and support services. All Indigenous peoples and people with a disability were successfully placed in an assignment. Feedback from the program has been very positive. Project respondents indicated they were able to secure the right capability, and participants noted the assignments were an excellent opportunity to develop new skills and work in a different area.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.14):

1. Our staff are engaged and empowered in their work.
2. Our innovation culture and operations enhance the wellbeing of our staff.
3. Our workforce is inclusive, harnessing the full potential of our people.

Table 3.14: Summary of our performance for enabling a healthy and sustainable organisation

PERFORMANCE MEASURES SOURCE: 2020–21 CORPORATE PLAN	TARGET	RESULT
Staff safety, health and wellbeing		
Staff Survey: staff wellbeing responses	71% positive	**Not achieved**: 68% positive. Changes in work arrangements due to COVID-19 presented connection and collaboration challenges, which we will address as a key focus area.
Hazard reporting (number of hazards recorded by staff in the health, safety and environment system)	1,080 reports	**Not achieved**: 517 reports due to most people not working on site.
Cultural health		
Staff Survey: Sustainable Engagement Score	81% positive	**Not achieved**: 80% positive, which is slightly below the target. Our people remained strongly supportive of CSIRO, but indicated there were challenges in getting work done due to priorities or resource-related issues. We are exploring different ways of working to better support our people.
Diversity in leadership: proportion of female leaders (as defined by organisation role)	34% female	**Achieved**: 37.6% female.

Staff safety, health and wellbeing

Staff wellbeing

This year, we were unable to conduct our regular, comprehensive staff survey due to disruptions from COVID-19, however we completed short and focused Pulse surveys in September and March. More than 3,000 people responded to the latest survey and nearly 70 per cent responded favourably to their wellbeing status. This result was only 2 per cent lower than the previous reporting period in June 2020 when we experienced peak scores in engagement and wellbeing. This is a testament to our regular programs that focused on improving our people's wellbeing throughout the COVID-19 disruptions.

Hazard reporting

In response to COVID-19, our people worked mostly from home where it was not essential for them to be on site. Our hazard reporting numbers for the year are significantly low at 517, which is nearly 50 per cent lower than our target of 1,080. It is expected that this number will improve as we progressively return to site with the improvement of COVID-19 conditions.

Cultural health

Diversity in leadership

We remain committed to increasing the diversity of our leadership teams across all levels. We recognise the importance of accessing the broadest pool of talent, networks, perspectives and experiences to drive the delivery of innovative and impactful solutions and outcomes. During 2020–21, our proportion of women in leadership positions increased from 35.7 per cent to 37.6 per cent, exceeding this year's target of 34 per cent. We have also exceeded our goal of 37 per cent by 2023–24 3 years early. This is a great result that demonstrates clear impact from our ongoing participation in gender equity initiatives, such as SAGE and the Champions of Change Coalition, and our commitment to our Diversity, Inclusion and Belonging Strategy.

Having met our baseline strategic goal, we can stretch even further. When broken into research, technical and enterprise support leadership roles, the relative percentages of leadership roles held by women was 27.4, 58.6 and 12.5 per cent, respectively.

While the average per cent of research leadership roles held by women at CSIRO (27.4 per cent) compares favourably to the national average of 22 per cent (Australia's STEM Workforce 2020, Office of the Chief Scientist), it sits below our percentage of female research staff (34.9 per cent). This suggests that we can do more to leverage our pool of potential future leaders into research leadership roles.

We are also exploring the representation of non-gender diversity in our leadership teams. For example, only 17.9 per cent of leadership roles are held by people from a non-English speaking background, which is under 24.2 per cent representation in all our people. At the intersection of gender and non-English speaking backgrounds, women hold 33.6 per cent of the 17.9 per cent of leadership roles held by people from a non-English speaking background, but 29.8 per cent of the 24.4 per cent of research leadership roles held by people from a non-English speaking background (higher than the 27.4 per cent research leadership roles held by women overall). We are striving to make improvements in this area in the coming year.

Sustainable engagement

Engagement is an overall measure of an employee's connection to their organisation and is closely correlated with productivity and performance. Sustainable engagement results based on our latest Pulse survey was measured as 80 per cent, which is a decline of 4 per cent since the previous June 2020 survey result. It is also a slight decline from our target of 81 per cent. This result was achieved as part of our short Pulse survey, which was responded to by a smaller proportion of our people, and does not necessarily compare with results normally obtained in our usual comprehensive surveys. The result demonstrates a continued trend in our people's views of leadership, strategic direction and communication.

Our internal reputation, also measured by the Pulse survey, showed that 93 per cent of our people are proud to be associated with CSIRO.

The results from this survey also showed an improvement since 2019 in keeping our people informed, and nearly 85 per cent of people reported feeling well-connected to their team, which is an increase of 9 per cent from the September result.

These survey results are above Australian average and R&D benchmarks.

4.2: Ensure CSIRO has sustainable operations, sites and infrastructure

Our key activities helped us achieve our strategic direction and aspirations:

- 2020–21 Security Action Plan
- 2020–21 Property Plan
- Increased agility of our operations.

We delivered on this requirement by:

- our finance, governance, information management, property and corporate affairs services supporting research and innovation activities, protecting our brand, and strengthening our reputation with key stakeholders
- developing our new Sustainability Strategy to ensure we have sustainable operations, sites and infrastructure to support our science and research.

Security

The safety and security of our people, property and systems is paramount. We regularly update and develop new and improved procedures as part of the Enterprise Security Program's implementation. Overseas travel procedures, personnel security pre-employment checks, and strengthened access control and security incident procedures have helped us to develop a robust security regime.

Our Security Action Plan recognises the need for our security approach to continue evolving. This ensures we are prepared for the increasing security threats we face as a science and research organisation. As part of that action plan, we are developing mechanisms to protect against foreign interference and forming strategic partnerships with government clients to protect sensitive projects. We are also working on a comprehensive cultural awareness package to improve our security awareness. The improved security regime will protect our people, assets and information.

Read more about our security on page 145.

Property

We manage many of Australia's state-of-the-art science infrastructure and biological collections, as well as a portfolio that includes 55 domestic sites, 3 international facilities and more than 950 buildings. We also have 28 minor locations where our people access desks or small areas of land. These sites and facilities enable our scientists to solve the greatest challenges through innovative science and technology.

Our 2019–29 Property Strategy provides a framework that articulates investment and divestment principles for decision-making to ensure our property portfolio provides fit-for-purpose infrastructure that is efficient, affordable and sustainable.

It incorporates Board-endorsed performance targets following the audit on our 2012 Property Investment Plan, and we have responded to all the Australian National Audit Office Report's recommendations. In most instances, this involved extending existing arrangements to ensure the recommendations were well incorporated. We committed to report our Property Strategy's implementation progress biannually – twice what was recommended – and set quantifiable performance targets. We also established stronger governance arrangements for property divestments. The timing of the audit did not align with the delivery of major consolidation projects, and benefits will be realised in 2021 onwards. For example, the exit from North Ryde and interim consolidation to Lindfield will realise significant operational savings.

Property Strategy progress

The 2020–21 property plan, which complements the 2019–29 Property Strategy, was impacted by unexpected events such as bushfires, hail damage and COVID-19, which led to a review of the strategy. Here is some of the progress we made this year.

We progressed the part-life refurbishment program for the Australian Centre for Disease Preparedness at Geelong. The project is on track and within budget.

We completed the design phase for a new national collections facility to house the Australian National Wildlife Collection, the Australian National Insect Collection, the Ethanol Collection, the Dadswell Wood Collection and support functions, including cryogenics and molecular and digitisation labs at our Black Mountain site with funding assistance from the National Collaborative Research Infrastructure Strategy (NCRIS). The project is progressing on time and in budget. Read more about our national collections on page 106.

The divestment of Ginninderra experienced further delays in the sale process. We continue to engage with the Australian Capital Territory Government, the National Capital Authority and the Department of Finance to provide clarity on external infrastructure works and planning, key agreed design principles and related economic development opportunities for the divestment. We anticipate returning to market for the sale of Ginninderra East in the second half of 2021.

We entered into a Participation Agreement with the Western Parkland City Authority to be an anchor tenant at Aerotropolis Bradfield in Western Sydney, where the majority of our Sydney operations will relocate to in 2026–27. This will enable the divestment of our Marsfield and Lindfield sites.

We received Parliamentary approval to consolidate our Perth sites, which will contribute to our sustainability goals and provide our people with more efficient and fit-for-purpose facilities.

In December, we closed our Alice Springs site.

In January, we closed our Kensington site at the University of New South Wales and transferred our people to our Eveleigh site, which is part of the Tech Central Innovation precinct.

We are working to ensure our offices remain vibrant following the extensive take up of working from home. We are also reviewing site arrangements to ensure all safety needs are met.

Our environmental impact

With over 5,200 employees located at 55 sites across Australia and 3 international sites, the nature, scope and geographic spread of our facilities and research is diverse. We operate national facilities on behalf of the Australian Government, including assets ranging from supercomputers and deep space radio telescopes to high-level containment (PC4) laboratories. Read more about our national facilities on page 96. We have a responsibility to ensure that we have sustainable operations, sites and infrastructure to support our science and research.

Sustainability Strategy

This year, we developed our new Sustainability Strategy 2020–30 to align with international best practice.

We identified the issues most material to us, which formed the basis of our approach and identified 6 key areas of focus:

- Governance and transparency: increasing transparency around sustainability performance through improved governance processes.
- Excellent science: working more closely with our scientists to apply CSIRO technical expertise to our operational challenges.
- Our people: creating a culture of sustainability and building capacity of our workforce.
- Sustainable property portfolio: ensuring a sustainable property portfolio that stimulates excellent science and supports our people's health and wellbeing.
- Transition to a clean energy future: improve energy management and efficiency on the path to net zero emissions.
- Responsible value chain: managing the environmental and social impacts of our procurements and embedding circular economy principles and responsible resource use.

These focus areas are underpinned by challenging targets and initiatives, and they are aligned to the UN Sustainable Development Goals[8], the Paris Climate Agreement[9], Commonwealth Procurement Rules[10], National Waste Policy Action Plan[11] and Australia's Technology Investment Roadmap[12].

8 United Nations Sustainable Development – 17 Goals to Transform Our World
9 The Paris Agreement, UNFCCC
10 Commonwealth Procurement Rules, Department of Finance
11 National Waste Policy Action Plan, Department of Agriculture, Water and the Environment
12 Technology Investment Roadmap: First Low Emissions Technology Statement 2020, Department of Industry, Science, Energy and Resources

We developed a robust governance and reporting framework to monitor the progress of the strategy's initiatives. We also introduced a new Sustainability Steering Committee with senior leaders from the strategy's focus areas, chaired by the Chief Operating Officer. The committee will monitor the strategy's implementation and provide guidance on its direction. In the coming year, we will also establish a research-based advisory group to provide a greater connection between our science research and operations as well as technical guidance to address operational challenges.

Transitioning to a clean energy future

Greenhouse gas emissions are a significant component of our environmental footprint and reducing them is central to our strategy. This year, the Board approved challenging targets and a roadmap to achieve net zero emissions by 2030 for Scopes 1 and 2 and to address material Scope 3 emissions by 2050.

Electricity use accounts for approximately 50 per cent of our energy portfolio. However, its associated greenhouse gas emissions are disproportionately larger, representing 80 per cent of our Scope 1 and 2 footprints. In response, our approach to reducing emissions focuses on increasing our electricity from renewable sources.

Corporate power purchase agreement

This year, we entered into a 10-year corporate power purchase agreement with Zen Energy to purchase renewable electricity each year to meet the needs of our managed facilities in Victoria, New South Wales and the ACT. The agreement covers approximately 70 per cent of our total electricity consumption in Australia. It has significantly reduced our electricity-related emissions and complements our onsite solar photovoltaic infrastructure.

Solar photovoltaics

We have over 13,000 solar panels installed across 11 sites that generate over 5 megawatts capacity of solar photovoltaics (PV). We continued to implement our onsite PV program and installed a 99-kilowatt roof-mounted PV system and a 40-kilowatt hour battery system at the Boorowa site in New South Wales, which provides more than half the site's electrical energy requirements. A 1.2-megawatt ground-mounted solar system is planned for the Tidbinbilla site in the ACT, which is expected to be completed in February 2022. We will continue to explore other sites for further installation opportunities.

Figure 3.6: Our energy breakdown

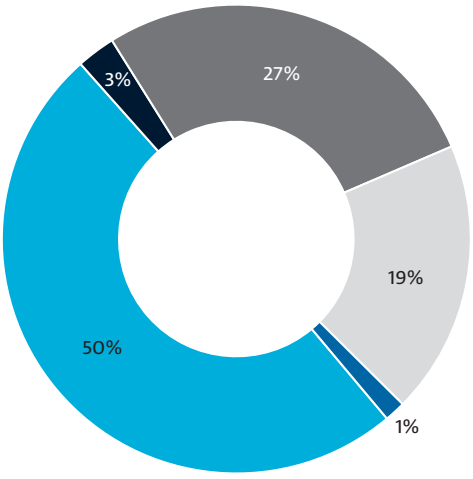
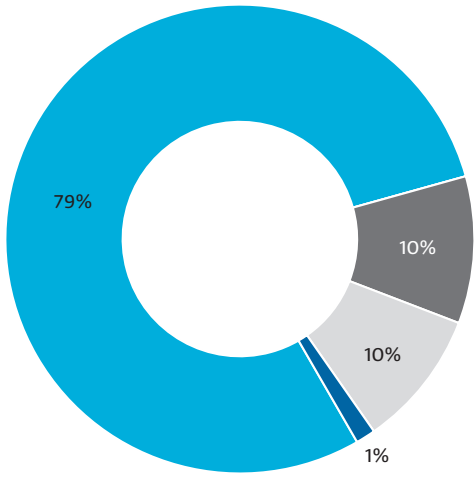


Figure 3.7: Our emissions composition (location-based)



Electricity · On-site solar · Natural gas · Liquid fuels (diesel, petrol, LPG) · Other sources

Newcastle 2025

As part of the roadmap to net zero emissions[13], we identified our Newcastle site as the first site to transition to net zero emissions (Scope 1 and 2), by 2025. Newcastle will serve as a test bed to trial emerging technologies and emissions reduction strategies. It will also inform the feasibility of broader deployment across our facility portfolio. Currently, the site has already achieved significant reductions through large solar installations and energy storage infrastructure. It will achieve net zero through a combination of energy efficiency and energy reduction programs, additional on-site renewable energy generation and storage solutions, electrification of plant and equipment and an accelerated adoption of electric vehicles. Newcastle is also the central hub for our Energy Business Unit, making it an ideal location for our first net zero site. We will also continue to work closely with our Towards Net Zero Mission[14] team to identify future sites to transition.

Pathway to sustainable buildings

This year, we developed our Sustainable Buildings program to ensure that we sustainably build, refurbish, operate and use our buildings with the health, wellbeing and comfort of our people at the forefront. It incorporates environmentally sustainable design principles built on industry best practice to develop climate-positive buildings, apply circular economy principles, and future-proof our buildings by addressing climate risks and carbon goals.

We developed a cloud-based data platform for managing built environment data, the Data Clearing House, as part of the Australian Renewable Energy Agency co-funded i-Hub initiative. We are using the Data Clearing House to track our building energy use, which will contribute towards our energy management and efficiency programs that support our net zero emissions targets.

Sustainable buildings stimulate excellent science and support staff health and wellbeing.

Ecologically sustainable development

We integrate environmental responsibility into our operations and minimise our environmental footprint through building infrastructure, behaviour change and minimising pollution.

Our Planning and Performance Framework includes impact evaluations and reviews to assess the environmental, economic and social outcomes from our work. Our operational and scientific procedures ensure that our research and site activities help to minimise our environmental impact. New building proposals or modifications to existing facilities undergo internal reviews to ensure we address safety, regulatory and environmental issues. We consider activities that fall under the *Environment Protection and Biodiversity Conservation Act 1999* to protect cultural and heritage-listed buildings.

Tracking our performance

Energy and emissions

Through our power purchase agreement for renewable electricity, we have purchased and voluntarily retired large-scale generation certificates (LGCs), which allowed us to account for the equivalent emissions reductions.

We have adopted a new dual reporting approach to accurately reflect the emissions reductions from renewable energy within our portfolio. This is in accordance with the Greenhouse Gas Protocol Scope 2 Guidance that requires Scope 2 emissions to be calculated and reported on a location-based (as per previous years) and market-based method. The location-based method reflects the average emissions intensity of the electricity grids where energy consumption occurs and does not consider our procurement for renewable energy.

The market-based method reflects the renewable electricity in our supply from procurement decisions, including our power purchase agreement with the purchase and retirement of LGCs.

13 https://csiro.au/en/about/strategy/Sustainability
14 Towards net zero – CSIRO

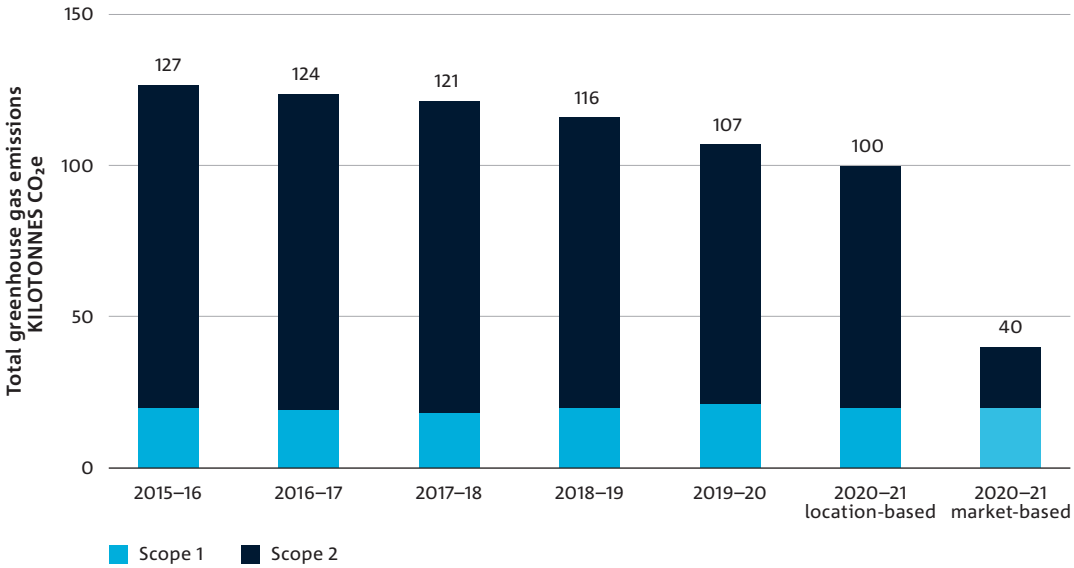
Location-based reporting

On a like for like basis (Scope 2, location-based), in 2020–21 our total greenhouse gas emissions for Scope 1 and Scope 2 (location-based) was 100 kt CO_2e. This is a reduction of 7 per cent compared to last year and 16 per cent from the average of the previous 5 years.

Our total energy usage, including self-generated renewables, was 715 terajoules, down by 6 per cent from last year, and 7 per cent from the average of the previous 5 years.[15]

This is largely due to lower on-site activity from COVID-19 disruptions and the ongoing benefit from our PV installations.

Figure 3.8: Our Scope 1 and 2 emissions



Some data has been estimated where data was not available at time of publication.

Table 3.15: Our energy (TJ) and greenhouse gas (GHG) emissions in kilotonnes of carbon dioxide emissions (kt CO_2e)

TOTAL ENERGY AND GHG EMISSIONS	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Total energy (TJ)	794	779	775	756	759	715
Total Scope 1 GHG emissions (kt CO_2e)	20	19	18	20	21	20
Total Scope 2 GHG emissions (kt CO_2e) location-based	107	104	103	96	86	80
Total Scope 2 GHG emissions (kt CO_2e) market-based	–	–	–	–	–	21
Total location-based emissions (kt CO_2e)	127	124	121	116	107	100
Total marked-based emissions (kt CO_2e)	–	–	–	–	–	40

Sum of scope 1 and scope 2 emissions may differ from total due to rounding.

15 Energy and emissions data have been restated for previous years to include all Scope 1 sources. Previously, electricity and natural gas were stated to the time of publication. Our boundary aligns with the Energy Efficiency in Government Operations boundary and excludes tenants.

Market-based reporting

In contrast, our Scope 2 (market-based) emissions fell to approximately 21 kt CO_2e due to the voluntary retirement of our LGCs.

The residual total Scope 1 and Scope 2 (market-based) greenhouse gas emissions were 40 kt CO_2e. This is approximately a 62 per cent reduction from the previous year because of our power purchase agreement and the retirement of our LGCs.

We have not included the associated emissions reductions from jurisdictional programs as part of our overall organisational performance metrics. However, we are in the process of reviewing the implications and methodology of accounting for jurisdictional targets.

Managing our waste

The diversity of our research, facilities, scientific waste and site locations makes waste management complex. This year, we continued to review our processes and identify improvement opportunities.

We have a target to divert an average of 80 per cent (by weight) of our waste streams from landfill by 2030. This year, we initiated a waste composition audit program to recognise the decline in our waste diversion rate.

We started with 4 of our sites and identified challenges with current resource recovery and opportunities to increase diversion rates. These audits provided key insights to behavioural and operational challenges and will inform the new waste strategy and implementation plan.

In 2020–21, our waste diversion rate was 36 per cent, which was marginally lower than the previous reporting period.

Water

Our mains water use across our facilities was 304 megalitres, which was 12 per cent lower than the previous reporting year. Lower occupancy at our sites has contributed to this moderate decline in water usage. We continue improving our water collection data, especially on sites where direct metering is not readily available.

Air travel

Air travel reduced significantly due to COVID-19 restrictions across Australia and internationally. In 2020–21, our passenger kilometres travelled was 92 per cent down from 2019–20, which represented a material decline in our overall air travel footprint.

Table 3.16: Waste, water and air travel metrics

	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Mains water usage (megalitres)	350	357	321	320	345	304
Waste to landfill diversion rate %	50	69	46	49	38	36
Air travel (million passenger kilometres)	117	110	114	123	84	7

Table 3.17: Intensity metrics

	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Energy intensity (GJ/FTE)*	163	156	149	141	150	144
Water intensity (kilolitres/FTE)	72	71	62	59	68	61
Air travel intensity (thousand km/FTE)	24.19	19.64	21.87	22.97	16.63	1.36

*GJ/FTE is gigajoules per full-time equivalent. FTE refers to CSIRO Officers at 30 June. Data adjusted for full energy and emissions.

Managing our heritage

We recognise our responsibility to conserve the Commonwealth and national heritage values of the places we own or control, and we manage these values under the *Environment Protection and Biodiversity Conservation Act 1999*. Our Heritage Strategy for CSIRO Land and Buildings 2016–26 outlines our objectives and responsibilities and has been endorsed by the Australian Heritage Commission.

In December 2021, we will provide DAWE with an update, including advice on all completed Heritage Assessment Reports and Heritage Management Plans, expenditure on heritage-listed facilities, and other items of note. For example, due to the forthcoming lease expiry of the Yarralumla site, we gifted the timber logging vehicles – Log Buggy, Log Tram Bogies and Logging Whim, which were located at Yarralumla – to Nangwarry Forestry Museum in South Australia. This ensures the vehicles will be maintained for years to come and available for public access.

In August, our iconic Parkes radio telescope, fondly known as 'The Dish', became the first functioning scientific instrument to gain national heritage listing due to its contribution to Australian astronomy and our understanding of the Universe.

The 60-year-old, 64-metre diameter telescope is best known for supporting NASA missions to explore our Solar System. In July 1969, alongside NASA's Honeysuckle Creek Station near Canberra, the telescope played a key role in receiving the television signals from the Apollo 11 mission to the Moon and sharing it with 600 million people around the world.

To mark the start of NAIDOC week, our Parkes radio telescope was honoured with a traditional name chosen by Wiradjuri Elders, which was revealed at a local naming ceremony. The name Murriyang represents the 'Skyworld' where a prominent creator spirit of the Wiradjuri Dreaming, Biyaami, lives (also known as the constellation Orion). Two smaller telescopes also received Wiradjuri names – Giyalung Miil ('Smart Eye') and Giyalung Guluman ('Smart Dish').

Read more about the Parkes facility on page 100.

All Heritage Management Plans and information on other Commonwealth heritage-listed sites are available at www.csiro.au/Heritage.

Communication

We are a trusted and respected organisation.

We measure our reputation through an annual community survey and use the insights to guide our communication and engagement activities. This year, public awareness remained high at 86 per cent, a slight decrease from last year's result of 88 per cent, and 65 per cent of Australians perceived us positively.

Our Corporate Affairs Strategy strengthens our brand and reputation by creating relevant opportunities for the community to engage with our organisation. This year, we focused on humanising our science and putting people at the heart of our storytelling.

We positioned CSIRO as an expert advisor on the COVID-19 pandemic through articles, media releases, expert scientific opinions and our first 'Ask our Researcher' Facebook Live event. It was a great opportunity to enable the community to interact directly with our experts, witness our science and receive answers around COVID-19.

We launched our first ready-made meals and a partnership that used our new brand impact mark. Our partner, Be Fit Food, saw a 3-fold increase in sales, generated 9 new business leads for CSIRO and reengaged 17 existing contracts.

Our January campaign for the Total Wellbeing Diet generated the highest program sales for a single month in history, just shy of 10,000 new members.

In February, a 3-month ASX-200 campaign culminated with the launch of our first customer event. The event built on momentum created from the release of the Futures ASX Innovation Survey, which considered the theme 'Corporate innovation and entrepreneurship'. We received over 600 registrations from decision makers in companies such as Australia Post, BHP, Blackmores, Boeing, Microsoft, Dulux Group, Telstra and the National Australia Bank.

We also took part in a new community engagement initiative, STORYBOX – an innovative 3D storytelling cube to showcase science, art and community content in community. The cube was situated in Darling Square, Sydney, and featured content with our key partners, including the ABC, National Film and Sound Archives, Sydney Writers Festival, City of Sydney, and Australian Film, Television and Radio School.

We continue to be a trusted source of information for many Australians with evidence-based content on how our science is creating a better future for all Australians.

Finance

Significant progress has been made in the management of our assets and prioritisation of the four-year capital budget, with the implementation of revised capital budgeting processes and templates. There are constraints within the capital budget, and further work is planned as part of the long-term action plan developed through the asset management review. We will continue to develop and adapt our strategic capital management plan for the future.

We adopted and sourced sustainable renewable energy supply for our operations, which accelerated our transition to a clean energy future.

Operations

Enhancing the science agenda

Cloud Right is a multi-year program to deliver assured multi-cloud services for use in our research. The program's first major milestone was to deliver assured cloud tenancies with Amazon Web Services, Microsoft Azure and Google Cloud Platform. Each of these tenancies is built with guardrails in place, which provides a secure and assured environment for our science. These tenancies provide access to cutting-edge digital tools and will be further built out in continuing phases of the project.

Other aspects of the program include a focus on delivering next generation in-house HPC and data infrastructure. This supports our AI initiatives and Internet of Things and looks to future quantum technology that will increase our ability to deliver computer-intensive research.

The goal of our digital strategy for science is to deliver a hybrid-technology environment that puts us at the forefront of digital science in Australia.

Our strategic partnerships with multinational technology providers have given us early access to cutting-edge technology and support the development of our technology roadmap.

Supporting business processes

We continued to digitise our corporate processes. This year, we created the Enterprise Support Digitalisation (ESD) Program to accelerate our digitalisation efforts across our enterprise-wide services. This multi-year program supports the Agency of the Future vision by implementing fit-for-purpose, digitalised enterprise services through process automation, digitisation and better digital collaboration. The program is developing the right digital solutions to support our operating model and people.

Transforming service delivery through support for New Ways of Working

After we transitioned to remote working during COVID-19, we supported our people and provided a laptop and home office equipment. Working from home is reliant on our high-bandwidth video conferencing and remote collaboration capabilities. We upgraded our video conferencing capabilities and are in the process of upgrading our internal broadband network from 10 gigabits to 100 gigabits between Sydney, Melbourne, Canberra and Perth.

We experienced a limited decrease in our people's productivity and dramatically increased the use of our digital collaboration technologies.

Embedding security into all information management technology services

Developing our enterprise digital capabilities also increases our cyber security. This year, we worked towards full compliance with Australian Signals Directorate's Essential 8 for our corporate systems and applied a risk-based approach for our science systems. We delivered a dedicated vulnerability management patching service. We limited administrative account usage, reviewed remote access arrangements and rolled out a new virtual private network solution. We also focused on cyber security awareness through user responsibilities and phishing training.

Our enterprise digital capabilities increase our cyber security.

Maximise the value of our information assets

We transitioned to open access publishing with new transformational agreements with global publishing houses of scientific information. We signed 8 new multi-year agreements, including with our largest partner for academic information, Elsevier. Many of these agreements are firsts for Australia.

Laboratory notebooks

Electronic laboratory notebooks were implemented to capture the data associated with the notebook research. This initiative improves our ability to defend our research and intellectual property.

We also started to revitalise our records management. This will help us to realise the benefits of 'in place' records management and discovery through cutting-edge AI tools.

Technology to support research data management as part of our Managed Data Ecosystem initiative continued to develop. This allows research teams to plan for their data needs in terms of IT and storage and business needs such as intellectual property, commercial, ethics and privacy. We are also moving the Data Access Portal to more stable infrastructure to support future data needs.

Increased agility and resilience of our operations

We commenced work to enhance the agility and resilience of our operations to manage disruptions such as COVID-19 on our people, customers and governance. We increased the maturity of our business planning and performance management to drive improved delivery and impact. We engaged McKinsey and Company to review our Annual Performance and Investment Process and our operating model to identify gaps and opportunities for improvement.

As a result of the review, we focused on refreshing governance and decision-making, enterprise process design, compliance arrangements, roles and responsibilities, and the delegation framework. We conducted a review of the Business Unit Advisory Committees. We also assessed the CSIRO Board Committees to determine their effectiveness in supporting our Business Units and our broader regulatory role of allocating access for the research community to our national facilities. The review looked at whether the committees remain contemporary and relevant in their primary purpose of providing external market and strategic advice to CSIRO and supporting the national research community.

The role of these committees was confirmed as appropriate. They provide valuable independent strategic advice and insights to our Business Units and our Board on the operations of the national research facilities. We will work on fostering greater consistency and connection across the committees to promote our cross-portfolio approach.

We matured our approach to identifying and managing risk and strengthened our ability to respond to significant issues and challenges. Read more about our risk management on page 147. We broadened our assurance focus and established a policy and compliance function to protect integrity, build public trust and complement our internal audit function.

We commenced work on providing greater clarity on roles and responsibilities for our leaders and refreshed our Delegations Framework to provide greater alignment and simplification. These activities will be implemented with a comprehensive change management communications and education package on the operating model changes for our people.

Analysis of performance

Our efforts this year contributed to us delivering towards our outcome:

1. We have efficient and sustainable operations and are able to move quickly to address opportunities, thus maintaining our capacity to innovate for Australia.

This year, our efforts to deliver efficient and sustainable operations and maintain our capacity to innovate for Australia included establishing an organisational-wide Sustainability Strategy and making commitments aligned with national and global goals. We adopted and sourced substantial renewable energy supply for our operations, which accelerated our transition to a clean energy future. We continue to recognise our responsibility to manage our impacts and have continued to improve our environmental performance. We substantially decreased our greenhouse gas emissions this year and achieved over a 60 per cent reduction compared to the previous year.

Our Sustainability Strategy contributes to meeting the Minister's expectation that we have sustainable operations.

We are implementing effective security strategies and measures to protect our people, information and assets through our Security Action Plan. Our 2019–29 Property Strategy provides the framework for prioritising our ongoing management and investment in sites including enhanced governance arrangements for property divestments. It incorporates the Australian National Audit Office Report's recommendations. Progress made with the 2020–21 property plan, despite impacts from unexpected events, included closing 2 sites and completing the design phase for a new national collections facility at our Black Mountain site.

Measures that increased the agility of our operations included strategic partnerships with multinational technology providers, revitalising records management, continuing to digitise our corporate processes and incorporating innovative practices into our work capabilities. We responded rapidly and effectively to the demands for our people to work at home by providing home office equipment.

Part 4

Our organisation

Our people

At the very core of our success are our people – passionate, dedicated and creative minds innovating for the benefit of Australia.

We engage a diverse workforce of scientists, engineers, technicians and professionals who have travelled from over 140 countries to bring their knowledge and expertise to our organisation.

Our people have diverse careers from laboratory technicians, research scientists, engineers, immunology specialists, astronomers and data science analysts to wine growers, deep sea divers, social psychologists, accountants, economists, human resource professionals and media specialists. With our flexible working options, many of our people contribute to their local communities as members of local fire brigades and animal rescue group members and Australian Defence Force Reserve Personnel. Our people also contribute in scientific advisory and consultative roles, as radiation safety officers and through participation in activities such as STEM in Schools to inspire the next generation of researchers.

We proudly changed our Enterprise Agreement to recognise the many different family situations of our people that include fostering, adoption, guardianship and surrogacy. This ensures equitable parental leave is available to all our people.

We also engage consultancy services when necessary. Read more about our consultancy services on page 152.

Our people numbers

At June 30, we employed 5,221 people. This small decline of 1.8 per cent from the previous year is not considered a significant workforce change. CSIRO manages its workforce strategically, in order to deliver against our science strategies and undertake the complex range of activities that we do as the national science agency. Our collaboration across the national innovation system extended beyond our people with an additional 2,872 affiliates, including fellows, distinguished visitors, students, contractors and other collaborators who all play a role in progressing our science. Read more about our people data, including details by state and gender at Appendix A.

Table 4.1: Our people (headcount) by functional area

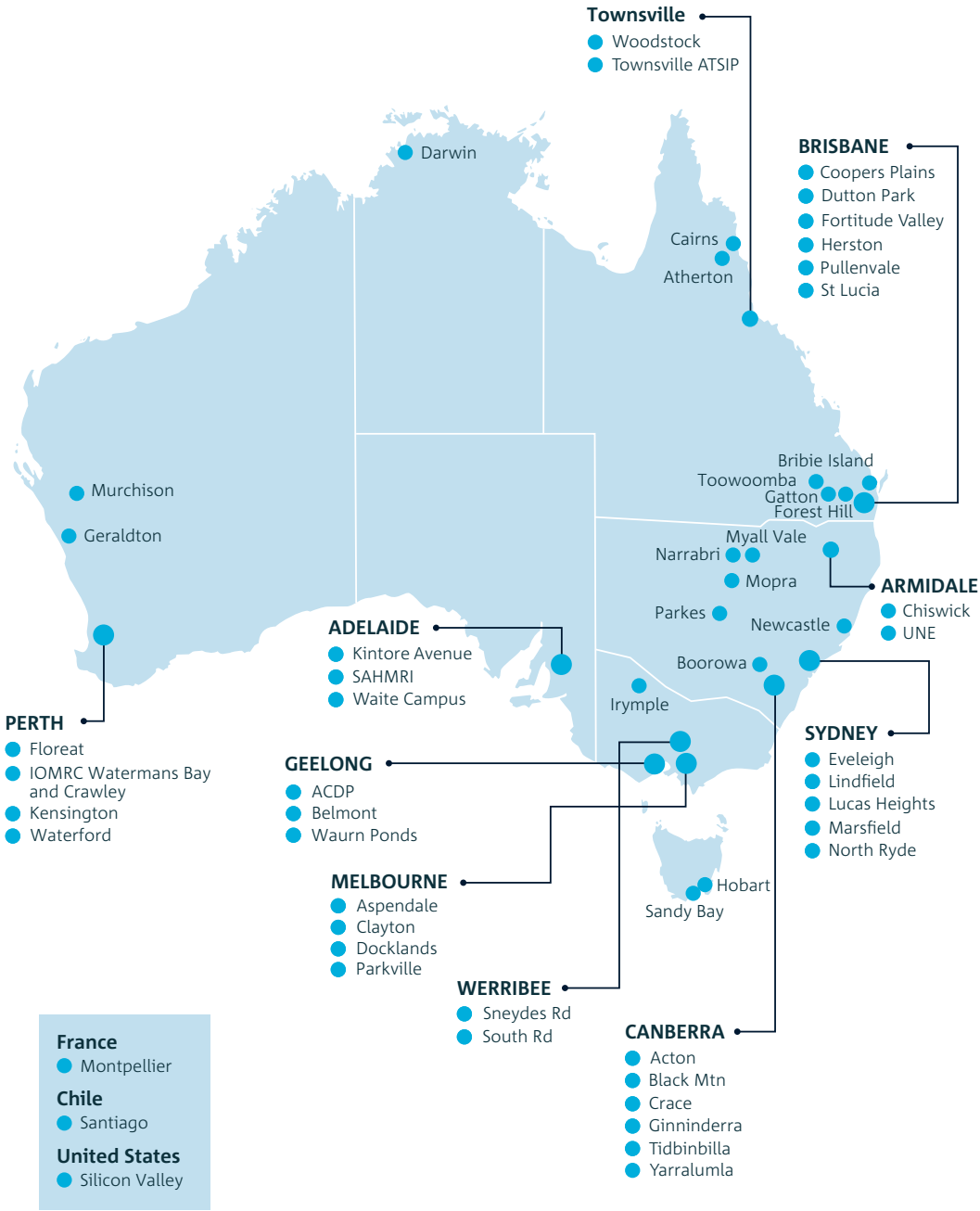
FUNCTIONAL AREA	2016–17	% FEMALE 2016–17	2017–18	% FEMALE 2017–18	2018–19	% FEMALE 2018–19	2019–20	% FEMALE 2019–20	2020–21	% FEMALE 2020–21
Research										
Research scientists/ engineers	1,473	27	1,533	27	1,570	28	1,485	28	1,424	28
Research project staff	1,803	41	1,809	42	1,829	42	1,521	41	1,504	40
Research management	246	19	251	22	233	21	250	24	252	29
Research consulting	58	22	55	26	53	25	60	28	57	25
Non-research										
Senior specialists	21	43	19	42	17	47	13	46	11	44
Technical services	621	16	672	17	719	17	683	16	665	18
Communication and information services	237	78	260	78	281	80	230	80	206	61
General services	20	55	19	53	16	50	8	38	8	64
Administrative services	942	75	999	75	1,046	75	930	75	946	72
General management	144	40	150	45	151	50	139	52	148	50
Total headcount	**5,565**	**40**	**5,767**	**41**	**5,915**	**42**	**5319**	**41**	**5,221**	**42**
Full-time equivalent (FTE)	**4,990**	**38**	**5,190**	**39**	**5,359**	**40**	**5065**	**40**	**4,949**	**40**

In 2016–17, the creation of Data61 led to the classification of new roles in General Management.

Our sites

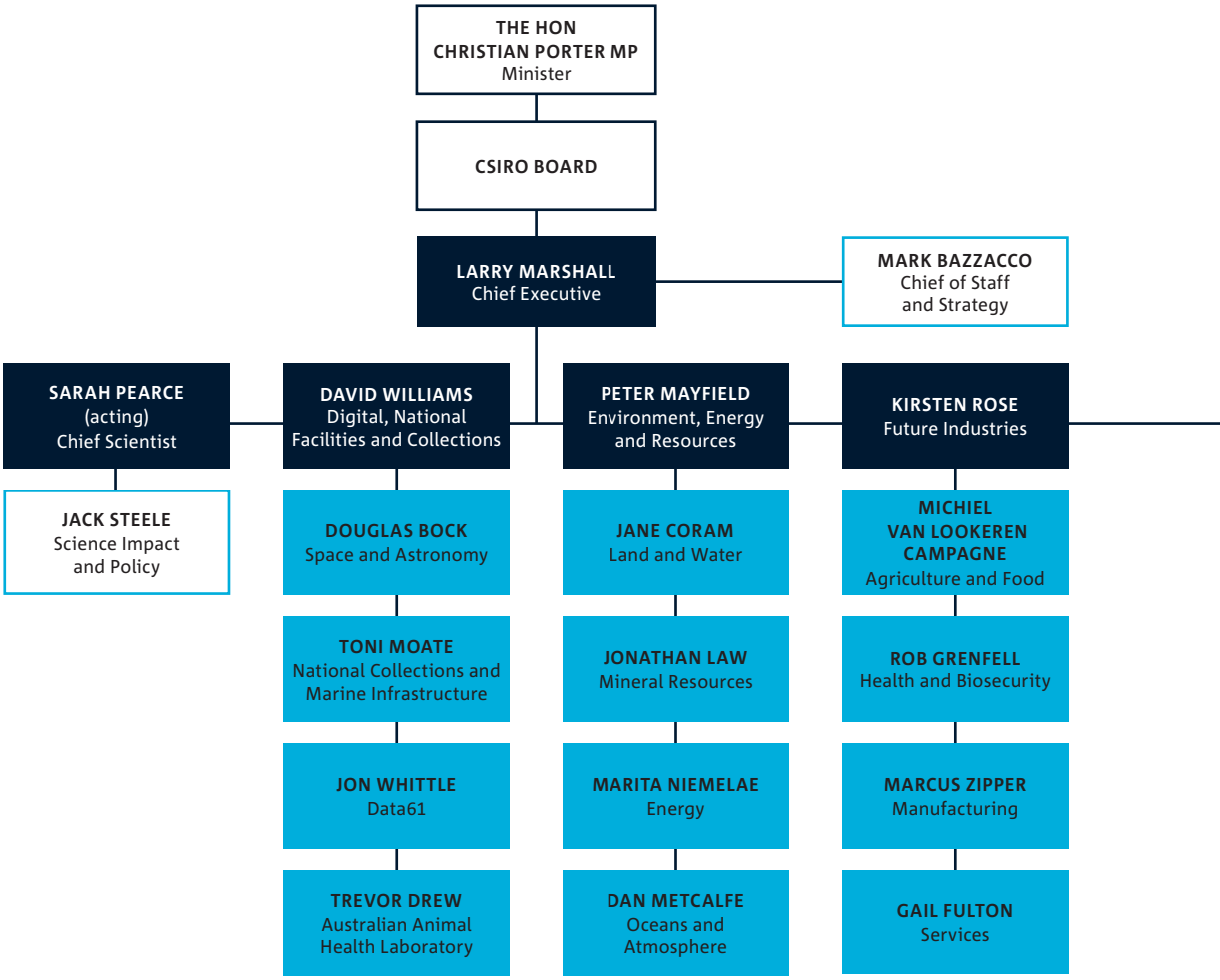
At 30 June 2021, we operated 55 sites across Australia and 3 sites overseas.

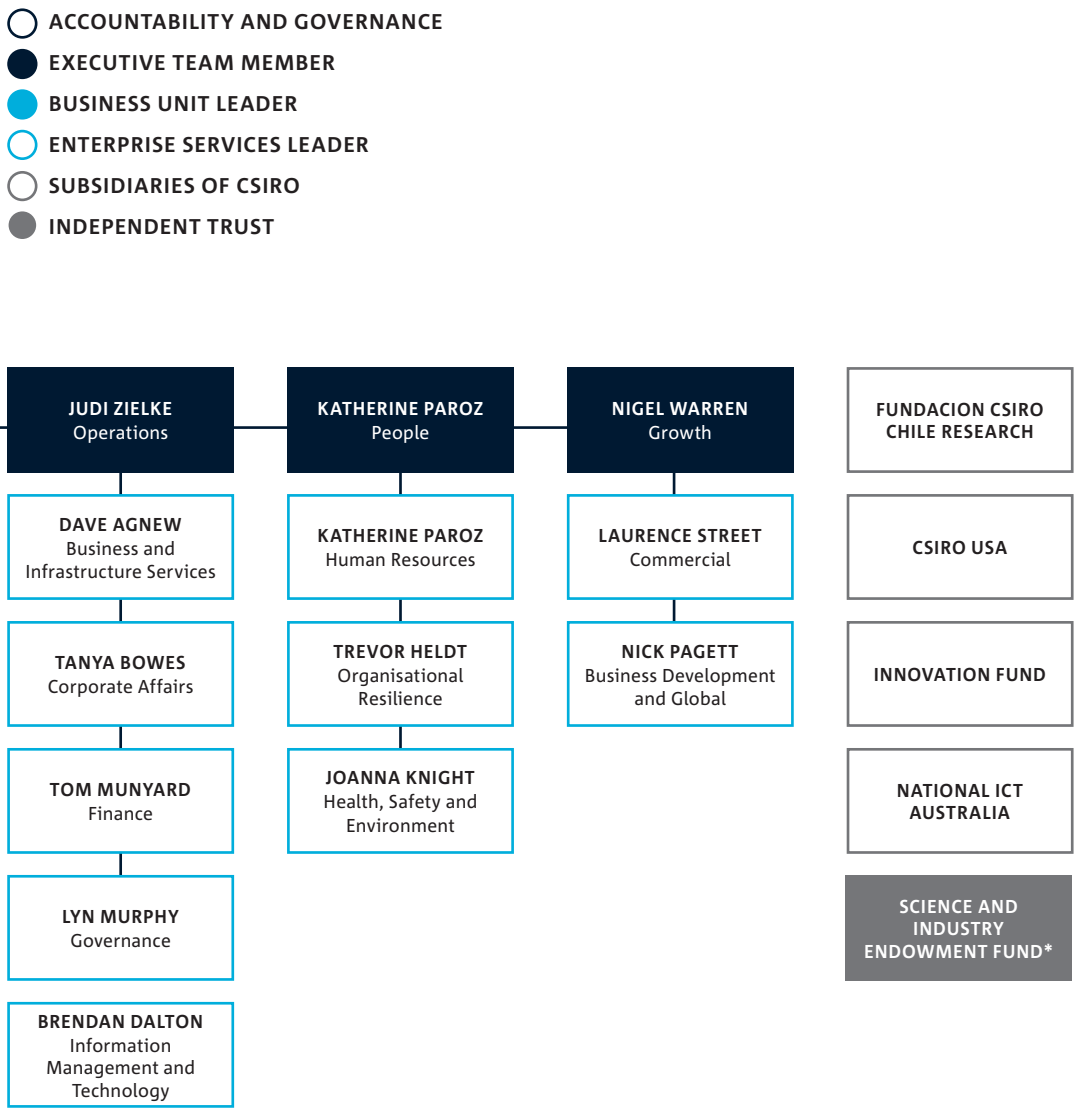
There are also 28 minor locations where our people may access desks or small areas of land for research purposes.



Our organisational structure

(as at 30 June 2021)





*Read about our subsidiaries in Note 3.4 of the financial statements in Part 5.

As Australia's national science agency, we have people, facilities and activities in all states and territories. Here are some examples.

Demonstrating the presence of SARS-CoV-2 in untreated wastewater in Brisbane

COVID-19 sewage surveillance has emerged as a powerful tool to inform public health professionals about the presence of infections in a community, supporting strategies for minimising community transmission and reopening economies.

As the COVID-19 pandemic took hold, the team at our quarantine and physical containment (PC2 BC2) accredited laboratory in Brisbane's Ecosciences Precinct began work to successfully demonstrate the presence of SARS-CoV-2, the virus which causes COVID-19, in untreated wastewater (sewage).
Read more about our wastewater work on page 26.

The team at our quarantine and physical containment accredited laboratory in Brisbane's Ecoscience Precinct.

Building future cotton success at Myall Vale

Myall Vale near Narrabri, New South Wales, is a new state-of-the-art cotton management research laboratory supporting our continued excellence in cotton research.

Myall Vale is home to our world-renowned Cotton Research Unit, which is helping to deliver high-yielding, high-fibre, disease-resistant cotton and a multi-billion-dollar annual export industry. Our Research Unit is a major tenant at the New South Wales Department of Primary Industries-owned Australian Cotton Research Institute.

The state-of-the-art cotton research laboratory was completed in February.

Developing foods with nutritional and health benefits in Adelaide

Our researchers at the South Australian Health and Medical Research Institute use the latest technology and equipment to lead scientific studies in nutrition research and health diagnostics. We provide recommendations to government agencies and companies worldwide, and we are currently looking at whether age-related cognitive effects can be reduced by increasing the dietary intake of complex milk lipids.

Darwin Living Lab: creating a cooler, more liveable tropical city

The future looks hot for Darwin. Climate projections suggest a significant increase in the average number of days per year above 35°C. In fact, the city is already experiencing the kind of increase in hot days that were predicted for the year 2030. In 2019, the City of Darwin declared a climate emergency, recognising the escalation of climate impacts in the city.

Commenced in 2019, the Darwin Living Lab is helping to make the city more liveable and sustainable. Our 10-year collaboration with the Australian and Northern Territory Governments and the City of Darwin arms decision makers with the best available science. In 2020, we released two reports that underpin the development of a collaborative Heat Mitigation Strategy for Darwin. One report maps the city's surface temperatures, identifying thermal hot spots and areas of high heat-health vulnerability in Darwin. The second report provides decision makers with strategies to deal with urban heat, looking at best-practice international examples.

Our researchers and our partners have worked on 5 projects over the past year. We're researching community needs for urban green space in Darwin; Larrakia-led biodiversity values; the City of Darwin's sensor data (helping Darwin residents manage their exposure to smoke and heat); the creation of a Digital Twin for Darwin; and ongoing work to monitor, evaluate and learn about the effectiveness of the collaboration.

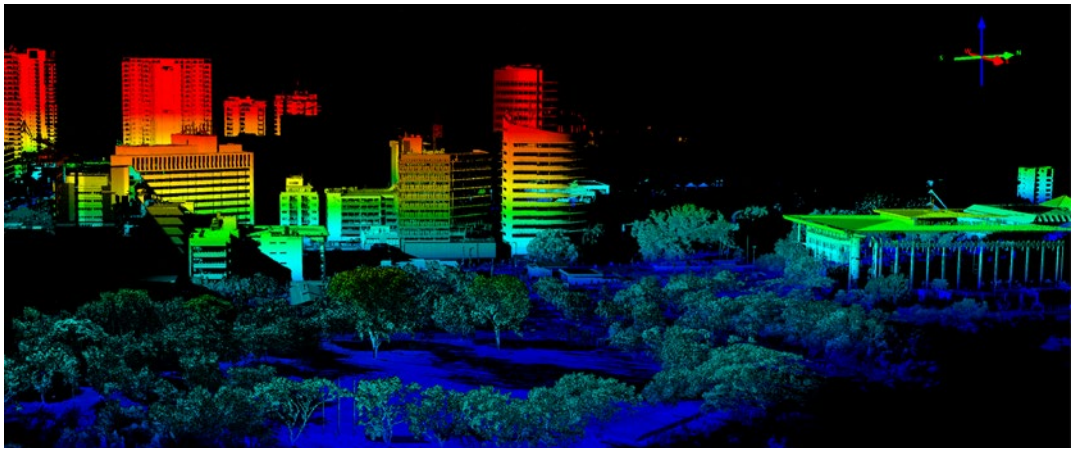
Over the next 8 years, our researchers will continue to bring together local community, our trusted scientific expertise and extensive innovation networks to strengthen capacity in Darwin to help create a cooler and more liveable city.

Reinforced carbon fibre facility at Clayton

We joined forces with Swinburne University of Technology to build and launch the National Industry 4.0 Testlab in composite additive manufacturing.

The Testlab is a world-first process for additive manufacturing of carbon fibre-reinforced composites at an industrial scale. It is located on our Clayton site in Melbourne within the Australian Manufacturing and Materials Precinct, close to Monash University.

The National Industry 4.0 Testlab in composite additive manufacturing was completed in October.



This image of Darwin was developed by Shaun Levick using 3D laser scanning technology, which is used to monitor the greening of Darwin.

Management and accountability

Government engagement

In 2020–21, our people held regular meetings with ministers, parliamentarians and senior staff from relevant government departments to discuss their needs, share research activities and provide scientific information. We also provided advice to inform policy development and program implementation and evaluation.

We made 8 submissions to parliamentary inquiries and our people provided information at 12 inquiry hearings. Inquiry topics included Australian aquaculture, dispatchable energy, fisheries quota systems, Australian bushfires, Australia's space industry, financial and regulatory technology, security risks for the higher education and research sector, tobacco harm reduction PFAS (Per- and poly-fluoroalkyl substances) remediation, feral and domestic cats, and the COVID-19 pandemic and Australia's trade and investment profile.

Legislation and government policy

We are a Corporate Commonwealth entity constituted and operating under the provisions of the *Science and Industry Research Act 1949* (SIR Act).

Our primary functions are to carry out scientific research to:

- assist Australian industry and to further the interests of the Australian community
- contribute to national and international objectives and responsibilities of the Commonwealth
- encourage or facilitate the application and use of the results of CSIRO scientific research.

Our secondary functions include international scientific liaison, training of research workers, publishing research results, making available scientific facilities, technology transfer of other research, providing scientific services, and disseminating information about science and technology.

Reporting, accountability and other rules for our operations are set out in the *Public Governance, Performance and Accountability Act 2013* (PGPA Act).

Pursuant to section 19 (1) (e) of the PGPA Act, we have had no instances of significant non-compliance with finance law in 2020–21.

We also provide administrative support services to the Trustee of the Science and Industry Endowment Fund (SIEF) consistent with the *Science and Industry Endowment Act 1926*. SIEF has its own governance structure. Read more about SIEF on page 205.

We received no government policy orders this year.

Responsible Minister

As at 30 June 2021, the responsible Minister for CSIRO was the Hon Christian Porter MP, Minister for Industry, Science and Technology.

From 1 July 2020 to 30 March 2021 the Hon Karen Andrews MP, former Minister for Industry, Science and Technology, was the responsible Minister for CSIRO.

Under the SIR Act, the Minister has power to:

- expand the purposes for which CSIRO carries out its scientific research
- provide to the CSIRO Board, in writing, directions and guidelines with respect to the performance of the functions, or the exercise of the powers, of the Board or of CSIRO (SIR Act, section 13(1)).

Ministerial directions and notifications

On 15 July 2014, the then Minister directed the CSIRO Board to apply the *Australian Government Public Sector Workplace Bargaining Policy* to Enterprise Bargaining Agreement negotiations in CSIRO. During 2020–21, we kept our responsible Minister and the Minister for Finance informed of our activities through our Board and in accordance with section 19(1)(a) of the PGPA Act.

Governance

The CSIRO Board is responsible under the SIR Act and the PGPA Act for our overall strategy, governance and performance. Section 12 of the SIR Act sets out the functions of the Board. The Board Charter and other details are available on our website.

The Board comprises 9 part-time, non-executive members, including the Chairman, and a full-time Chief Executive. At 30 June, there were no vacancies on the Board. All non-executive Board members are appointed by the Governor-General. The Chief Executive is appointed by the CSIRO Board, in consultation with the Minister pursuant to s10B of the SIR Act.

In 2020–21, our Board operated in part through 3 standing committees.

The Audit and Risk Committee assists the Board in fulfilling its corporate governance responsibilities regarding financial reporting, audit and risk oversight, reporting obligations, and internal controls and compliance with relevant laws and policies.

The People and Safety Committee assists the Board to meet its governance responsibilities relating to people, health and safety strategies, obligations, performance and culture.

The Science Excellence Committee assists the Board to fulfil its governance responsibilities regarding science, capability and strategic plans to ensure CSIRO maintains its reputation for scientific excellence and capacity to respond to national challenges and opportunities.

As required under the PGPA Rule, all members of the Audit and Risk Committee are not employees of CSIRO. The Audit and Risk Committee's charter is available on our website: www.csiro.au/en/about/corporate-governance/minister-and-board/barc. Read more about the Committee members at Appendix C.

On appointment, Board members are formally inducted in the organisation's functions, operations and activities and their duties and responsibilities as a member of the Board of a Corporate Commonwealth entity. Board members are provided with a comprehensive set of documents, including the PGPA Act, SIR Act, Corporate Plan, Risk Management Framework, and key plans and policies.

Members maintain their professional development and participate in CSIRO site visits, as well as governance and business briefings. Members may seek independent professional advice and liaise with CSIRO senior management in keeping with their duties, responsibilities and obligations as Board members.

Under its Charter and Operating Guidelines, the CSIRO Board examines its performance, composition and skill base regularly to ensure it is operating efficiently and effectively and following the principles of good corporate governance. Board performance is usually reviewed at least every 18 months; the most recent was a self-assessment in March 2020.

Details of remuneration are reported in Note 3.3 of the Financial statements in Part 5. Details of Board meeting attendance are in Appendix D.

Board membership

Mr David Thodey AO

Dr Larry Marshall

Ms Kathryn Fagg AO

Dr Michele Allan

Mr Drew Clarke AO

Prof Edwina Cornish AO

Mr David Knox

Prof Tanya Monro

Dr Peter Riddles AM

Prof Michelle Simmons AO

Mr David Thodey AO – Chairman (non-executive)
BA FAICD (15 October 2015 to 14 October 2021)

Mr Thodey is a business leader and company director focused on innovation, technology and digital, with more than 30 years' experience, including as Chief Executive Officer of Telstra and Chief Executive Officer of IBM Australia and New Zealand. He is an experienced board director and Chair, and his current positions include director of Ramsay Health Care and Chair of Tyro Payments Ltd and Xero Limited.

Dr Larry Marshall – Chief Executive BSc (Hons) PhD GAICD FTSE (1 January 2015 to 30 June 2023)

Dr Marshall is a scientist, technology innovator and business leader with over 25 years' experience in creating new value and impact with science. He founded 6 successful companies in biotechnology, photonics, telecommunications and semiconductors in the United States, and has served on 20 boards of high-tech companies operating in the United States, Australia and China. Dr Marshall believes CSIRO is the essential catalyst to improve Australia's innovation performance.

Ms Kathryn Fagg AO – Deputy Chair (non-executive)
BE (Hons) Chem Eng and MCom (Hons) FTSE GAICD
(2 August 2018 to 16 September 2025)

Ms Fagg, an experienced director, senior executive and engineer, has worked in logistics, manufacturing, resources, banking and professional services, including with Linfox, BlueScope Steel and the ANZ Banking Group. She also served on the Board of the Reserve Bank of Australia. Her current board positions include Chair of Boral to 30 July 2021 and Breast Cancer Network Australia and member of the boards of Myer Foundation, National Australia Bank and Djerriwarrh Investments.

Dr Michele Allan – Member (non-executive)
BAppSc MMgtTec MCommLaw DBA FAICD
(5 May 2016 to 4 May 2024)

Dr Allan is an experienced company director with significant skills and competencies in the university, private and public sectors and expertise in food and advanced manufacturing. Her background is in biomedical science, management and law. Dr Allan's current positions as Chair include Apple and Pear Australia, Charles Sturt University, Food and Agribusiness Growth Centre, Defence CRC for Trusted Autonomous Systems and Wine Australia. She is also a Director of the Food Agility CRC, Dairy Food Safety Victoria, MJCP Holdings Pty Ltd and SmartSat CRC.

Mr Drew Clarke AO – Member (non-executive)
PSM BAppSc (Surveying) MSc GAICD FTSE
(24 August 2017 to 23 August 2022)

Mr Clarke is a company director offering applied science, public policy and government administration expertise from over 20 years in senior roles in the Australian Public Service, including as Secretary of the Department of Resources, Energy and Tourism, Secretary of the Department of Communications and Chief of Staff in the Office of the Prime Minister. He is Chair of Australian Energy Market Operator Ltd, a director or NBNCo and a member of the Commonwealth Low Emission Technology Investment Advisory Council. Mr Clarke also chairs advisory groups relating to energy transition research and Antarctic science research.

Professor Edwina Cornish AO – Member
(non-executive) BSc (Hons) PhD FTSE AICD
(26 November 2015 to 25 November 2023)

Professor Cornish is a director with senior executive experience in research and higher education. She brings vast experience in the interface between government, research, science and higher education and provides strong business, industry and financial skills. Professor Cornish played a key role in building one of Australia's first biotechnology companies, Florigene Limited, which developed and commercialised the world's first genetically modified flowers. She is on the Council of La Trobe University, the Chair of the University of Queensland – Indian Institute of Technology Delhi Academy Strategic Research Advisory Council, and a member of Biosciences Research Centre joint venture and Biosciences Research Centre Pty Ltd.

Mr David Knox – Member (non-executive)
BSc (Hons) Mech Eng MBA FIE Aust FTSE GAICD
(5 May 2016 to 4 May 2024)

Mr Knox, an experienced company director with a background in oil and gas, was formerly the Managing Director and Chief Executive of Australian Naval Infrastructure (until 3 April 2020), and Chief Executive Officer and Managing Director of Santos Limited (2008–15). He is currently Chair of Snowy Hydro Limited and the Australian Centre for Social Innovation, and he is a Director of Migration Council Australia, Adelaide Festival Board, Redflow and Micro X.

Professor Tanya Monro – Member (non-executive)
BSc (Hons) PhD FAA FTSE FOSA FAIP GAICD
(25 February 2016 to 24 February 2024)

Professor Monro is the Australian Chief Defence Scientist. She was previously Deputy Vice Chancellor Research and Innovation and an Australian Research Council Georgina Sweet Laureate Fellow at the University of South Australia. Her executive experience in industry and education includes research in photonics focusing on sensing, lasers and new classes of optical fibres. Professor Monro is a director of Red Chip Photonics, Science Patron of the National Youth Science Forum, and a member of the South Australian Premier's Economic Advisory Council and National Committee for Physics.

Dr Peter Riddles AM – Member (non-executive)
BSc (Hons), PhD, Grad Dip Bus FAICD
(24 April 2014 to 23 April 2022)

Dr Riddles is an experienced company director and advisor. He has worked as a research scientist in molecular biology in the public sector including CSIRO, on commercialisation and new venture creation and government policy development. His expertise is in biotechnology and entrepreneurship in higher education and research. His other roles include member of the Science and Industry Endowment Fund (SIEF) Advisory Council, Chair of SIEF Advisory Council Experimental Development Program Committee, Chair of Infrastructure CoLaboratory Advisory Board and director of Hear and Say Centre for Deaf Children Ltd.

Professor Michelle Simmons AO – Member
(non-executive) BSc Physics (Hons) BSc Chemistry (Hons) PhD FRS FAA FAAAS FTSE FInstP Dist FRNS
(17 September 2020 to 16 September 2025)

Professor Simmons is Director of the Centre of Excellence for Quantum Computation and Communication Technology at the University of New South Wales and Founder and Director of Silicon Quantum Computing. She has pioneered new technologies to build computing devices at the atomic scale. Professor Simmons has been recognised by the American Computer Museum as a pioneer in quantum computing and was awarded the US Feynman Prize in Nanotechnology. She is a member of the University Research Commercialisation Scheme Taskforce and National Intelligence Scientific Advisory Board.

Read more about the accountable authority members in Appendix B.

CSIRO Executive Management

(as at 30 June)

Dr Larry Marshall

Ms Judi Zielke

Dr David Williams

Ms Kirsten Rose

Dr Sarah Pearce

Dr Peter Mayfield

Ms Katherine Paroz

Mr Nigel Warren

The Chief Executive is accountable for managing the affairs of the organisation according to our strategy, plans and policies approved by the Board as well as the Board Directions to the Chief Executive (section 10A (3) SIR Act).

The Executive Team (ET) supports our Chief Executive. As a team and through their individual roles, ET members lead, direct, coordinate and control our operations and performance in line with the Executive Team Charter. The Charter is available on our website. ET's responsibilities include developing the Corporate Plan 2021–22 and the Budget. Newly appointed ET members undergo a formal induction process to ensure they are aware of their responsibilities.

ET is assisted by the Major Transaction Committee, the CSIRO Security Committee, the Audit, Risk and Compliance Committee and the Enterprise Change Committee.

Dr Cathy Foley served on the Executive Team until the end of December. Dr Sarah Pearce served on the Executive Team from January to June.

The **Major Transactions Committee** (MTC) is responsible for managing and directing our involvement in major transactions and related matters and investment, to ensure the soundness, strategic alignment and potential risk of such transactions. MTC reviews proposed transactions and advises the ET on matters related to proper and efficient performance of business development, intellectual property management and technology transfer activities. During 2020–21, the MTC met on a fortnightly basis with 24 meetings scheduled.

The **CSIRO Security Committee** is responsible for ensuring the effectiveness of our security strategies, programs and measures to protect our people, information and assets. During 2020–21, this committee held 7 meetings. There were no items for approvals in this financial year.

The **Audit, Risk and Compliance Committee** (ARCC) is a committee of the ET under the authority of the Chief Executive. ARCC provides objective advice and assistance to the ET in fulfilling its corporate governance responsibilities by overseeing and monitoring the organisation's corporate governance financial reporting, risk and internal control frameworks, its legislative and policy compliance and its internal audit function requirements.

ARCC, a new committee this year, held its first meeting in September and met 6 times. ARCC has expanded its knowledge of compliance, fraud, and audit and risk frameworks including analysis of transactions.

The **Enterprise Change Committee** (ECC) supports the ET to manage and prioritise our major change projects involving IT and system development. During 2020–21, ECC held 10 meetings.

Our Leadership Team of senior managers provides a forum for sharing and discussing issues relating to our management and future strategy.

Remuneration of key management personnel, executives and other highly paid staff

Remuneration details are provided to meet enhanced disclosure requirements as required under the *Public Governance, Performance and Accountability Rule 2014* (PGPA Rule). Remuneration of key management personnel, senior executives and other highly paid staff is reported in detail in Note 3.2 of the Financial statements in Part 5. Annual reportable remuneration includes base salary, benefits and allowances, performance payments, superannuation, termination benefits, long service leave, and other short-term and long-term benefits. The remuneration reported has been calculated on an accrual basis and does not equal actual remuneration paid in 2020–21.

Enterprise agreements

Enterprise agreements set the terms and conditions of employment for our employees. Two enterprise agreements are in operation: the CSIRO Enterprise Agreement 2020–23 and the CSIRO Canberra Deep Space Communication Complex (CDSCC) Enterprise Agreement 2018–21.

The CSIRO Enterprise Agreement 2020–23 came into operation on 15 November 2020. It reaches its nominal expiry date on 16 November 2023.

The CSIRO CDSCC Enterprise Agreement 2018–21 came into operation on 21 February 2019. It reaches its nominal expiry date on 20 February 2022.

Remuneration policy, strategy and governance

Our remuneration policy considers applicable remuneration provisions within both the CSIRO Enterprise Agreement 2020–23 and the CDSCC Enterprise Agreement 2018–21. Clauses 11 and 12 of the CSIRO Enterprise Agreement 2020–21 provide for market-related remuneration and individual flexibility arrangements. The remuneration policy also considers the Public Sector Workplace Relations Policy 2020, including the requirement to implement a 6-month wage increase deferral and suspend increases to remuneration for senior executives and equivalent until the resolution of the COVID-19 pandemic. Key management personnel, executives and other highly paid staff are remunerated in accordance with their contracts of employment and relevant governing provisions.

The Chief Executive is a position within the Commonwealth Principal Executive Officer structure. The Remuneration Tribunal sets the Total Remuneration reference rate and the maximum achievable performance payment.

Remuneration for members of the CSIRO Board is established by Determination of the Remuneration Tribunal for Part Time Office Holders. Determinations of the Remuneration Tribunal are established in accordance with the *Remuneration Tribunal Act 1973*.

The Remuneration Committee

The CSIRO Board People and Safety Committee assists the Board to fulfil its governance responsibilities for organisational development, people-related activities, and health and safety. In relation to remuneration and performance, this Committee:

- makes recommendations to the Board on the remuneration and performance of the Chief Executive, including possible key result areas and performance targets
- reviews the Chief Executive's decisions regarding the remuneration and performance assessment of Executive Team members and ratifies these recommendations as appropriate
- exercises oversight of our executive remuneration policy, including the senior executive banding structure (focus on positions not individuals) and with references to the market
- specifically oversees negotiations with the Chief Executive or nominee regarding terms and conditions of appointment.

Remuneration Framework

The Chief Executive evaluates and determines the appropriate level of pay for executive positions in line with our executive remuneration policy. Our Remuneration Framework comprises fixed and variable components. Base salary is determined on a range of factors, including work value assessments, individual performance, competence and skill, internal relativities and external market rates. The annual variable 'at-risk' component of remuneration is based on the achievement of pre-determined key result areas.

Annual remuneration review

Remuneration levels for executives are reviewed annually by the Chief Executive and the Board People and Safety Committee who assess any increases and performance payment structure for the next financial year.

The annual remuneration review considers:

- market competitiveness
- individual performance
- organisation performance and affordability.

Market-related remuneration arrangements may increase because of contract provisions aligned with Enterprise Agreement salary increases or by market-related adjustments, which are determined annually by the CSIRO Board People and Safety Committee.

The Committee makes recommendations to the CSIRO Board on the Chief Executive's remuneration and performance, including possible key result areas and performance targets. The CSIRO Board determines the Chief Executive's remuneration and any applicable performance payment within the range set by the Remuneration Tribunal after the Tribunal's annual determination of the reference rate.

Disclosure of interests and related entity transactions

Board members and the Chief Executive declare material interests as required under the SIR Act and PGPA Act. The Board Governance document has processes for managing conflicts of interest, including a requirement that members absent themselves from discussions and voting where a member has declared a material personal interest, or where a potential or actual conflict of interest or duty arises.

In 2020–21, the Board did not consider any transactions where a Board member was also a director on or employed with the entity involved in the transaction.

In accordance with the CSIRO Delegations, the CSIRO Board approves transactions (commercial, property, procurement) when the overall value (total of all contributions from all parties) is above $20 million or transactions that are high risks, are sensitive in nature and are long-term strategic commitment by the organisation. All major transactions are approved by the Board.

Transactions below $20 million and greater than $5 million are approved by the Chief Executive after the Major Transactions Committee, a sub-committee of the Executive Team, has reviewed the transactions against CSIRO policies and recommended them for Board or Chief Executive approval. All transactions under $5 million are approved by the suitable delegate in accordance with CSIRO policies and procedures as well as Government regulations.

In 2020–21, there were 20 transactions involving entities related to CSIRO above $10,000, which came to a total combined value of $27.4 million.

Identifying and managing our risks

The identification and management of risk is central to solving the greatest challenges through science and technology. While we acknowledge that breakthrough science, innovation and collaboration may carry significant risk of technical or scientific failure, we are committed to managing all risks and mitigating their consequences in a considered and effective way. Similarly, we recognise that to achieve our purpose we must be prepared to take measured and managed risks to ensure that the enabling elements of our organisation are optimised to best support the achievement of our objectives.

While embracing necessary risk-taking, we also recognise that we have low to no tolerance of actions and behaviours that undermine the safety and security of our people, the integrity of our science and the protection of the environment in which we operate.

Our Risk Framework, methodology and approach are grounded in and aligned with both the international standard AS/NZS ISO 31000 Risk Management Principles and Guidelines and Commonwealth Risk Management Policy. Our Risk Framework is applied across the organisation at the enterprise, Business Unit/Functional and activity levels.

The CSIRO Board supports our efforts to identify and manage our risks through 3 Board standing committees (read more about these committees on page 141):

- People and Safety Committee
- Audit and Risk Committee
- Science Excellence Committee.

In 2020–21, we continued to strengthen and increase our risk maturity and culture of undertaking projects having fully considered the potential risks and effective management of those risks within organisational tolerances. This year, we:

- demonstrated the effectiveness of our risk framework and Situation Management Framework specifically to support organisational resilience in our ongoing response to COVID-19
- strengthened the monitoring of risks, controls and risk treatment plans through a series of actions that included:
  - introducing a new Audit, Risk and Compliance Committee to strengthen executive and senior management's oversight of risks and controls
  - establishing a Policy and Compliance function as part of our enterprise governance arrangements
- strengthened the integration and alignment of risk into key business processes and increased:
  - the risk capability applied to each element of our strategic planning and execution framework
  - the application of existing risk identification and recording processes (risk registers) into day-to-day management and decision-making at a Business Unit level.

Our Organisational Risk Profile articulates how we manage our key risks at an enterprise level. These include risks associated with the conduct and translation of research to outcomes and impact, people and culture, financial, customers and markets, health and safety, security, environmental, governance and integrity risks. By actively identifying and managing strategic, operational and external risks, we aim to increase our effectiveness as an organisation and provide greater certainty and confidence for the Government, our people, collaborators and other stakeholders in the community about our operations.

The Risk Profile is developed through consultations and extensive engagement with organisational leaders across the executive and all Business Units and functions. It involves an internal and external environmental scan that considers external, strategic and internally generated risks with the potential to impact the achievement of our objectives.

The Risk Profile was reported to the Board Audit and Risk Committee and the Board at their meetings in November. Key risk activities and changes to the Risk Profile are reported to the Board Audit and Risk Committee throughout the year. In 2020–21, this included discussions about relevant risks with the Audit and Risk, Science Excellence, and People and Safety Committees.

Our insurance arrangements with Comcover include cover for Directors and Officers Liability, General Liability and Professional Indemnity along with other normally insurable risks. The annual premium attributed to Directors' and Officers' insurance for 2020–21 was $402,220. Our workers' compensation liability is covered through Comcare for which an annual premium is also paid.

Advisory mechanisms

Our 9 advisory groups advise our researchers on our longer-term strategic direction and research and development priorities, and how we can meet the research, technical and business needs of customers and communities. The groups meet at least twice a year, or more regularly if required. The groups provide advice relating to the effectiveness of our businesses to achieve their goals. The groups comprise representatives from industry, government, non-government organisations and other stakeholders.

Policy Framework

Our Policy Framework comprises policies, principles, procedures and guidance materials to establish our responsibilities and commitments, performance requirements and mandatory actions in carrying out tasks. Our Policy Framework ensures that staff have access to clear documentation that explains their obligations and how to fulfil them lawfully. The Policy Framework is integral to our governance.

The policies, approved by our Board, reflect our commitment to:

- research and technology
- science and delivery
- governance
- risk
- health, safety and environmental sustainability
- people
- child safety
- finance and shareholding
- privacy.

This year, we submitted our 2019–20 Modern Slavery Statement to the Australian Border Force Register to meet our reporting obligations under the *Modern Slavery Act 2018* (Cth). The statement reports on the risks of modern slavery in the operations and supply chains of the organisation, and it identifies actions to manage, lessen and where possible remove those risks. It is available on our website.

Our Policy Reform Project supports the continual streamlining of our policies, principles and procedures, and is intended to lead to improved transparency, accountability, efficiency and effectiveness in the daily work of all our people.

This year, the Policy Reform Project simplified compliance requirements in procedures, with clearly stated roles and responsibilities and detailed process guidance extracted to support material.

Roles and Responsibilities Project

As part of our ongoing work to better enable our people, we are working to enhance the way senior leadership roles and responsibilities are defined and articulated. This project will also ensure that those performing senior leadership functions have the right contemporary resources available when executing their responsibilities.

Ethics and Code of Conduct

The CSIRO Code of Conduct sets out the standard of behaviour expected of our people and others working in the organisation. All our people and affiliates must undertake training in the code as part of their induction and every 2 years.

Ethical conduct is a priority and we have procedures for Ethical Conduct in Human Research and Animal Welfare for the care and use of animals in scientific research. Our practices comply with national codes and relevant state and national legislative requirements. We operate 2 human research ethics committees to cover our social and interdisciplinary science and health and medical-related research. These committees review about 330 new projects each year and provide ongoing monitoring and support for more than 600 active projects at any given time. The committees provide independent, expert advice on appropriate engagement of people and communities in research and the use of human data. Issues such as privacy, informed consent, and the risks and benefits flowing from research are effectively managed through this review process.

We operate 4 Animal Ethics Committees that review our use of animals in research. This covers a range of fields, including wildlife conservation, farm animal production, nutrition, disease control and prevention, and human health. These committees review about 95 new projects each year. They also play an active role in monitoring the care and wellbeing of animals during any research and ensure we comply with all regulatory requirements. Ongoing support and monitoring are provided for more than 190 projects at any given time.

Targeted training programs on human and animal research ethics is provided to our people and ethics committee members each year to ensure capability levels for responsible research practice are supported and maintained. Training programs include both broad and comprehensive training on human and animal research ethics standards and processes, as well as training on ethical issues in specific areas of research. We also provide online resources and individual advice to support best practice.

The responsible conduct of our research is vital to maintain our trusted status. Our Science and Delivery Policy and Code of Conduct enshrine our adoption of the National Health and Medical Research Council's *Australian Code for the Responsible Conduct of Research (2018)*. We provide mandatory training for research staff and senior leaders in research integrity; targeted training on specific research conduct issues; and a network of Research Integrity Advisors across the organisation to support best practice and provide advice to our researchers. We proactively monitor and assess our organisational alignment with research integrity standards and the effectiveness of our management of any breaches of responsible conduct to ensure we maintain best practice approaches.

Internal controls

We comply with section 10 of the PGPA Rule by establishing and maintaining an effective fraud control framework. Our Fraud and Corruption Control Plan 2020–22 comprises strategies to prevent, detect, respond to and report fraud and corruption affecting CSIRO, and it is complemented by our policy and procedures, system and internal controls, financial management, assurance and accountability activities, and an Enterprise Risk Framework. We adhere to the Commonwealth Fraud Control Framework 2017's 'Fraud Rule' and endeavour to apply the Fraud Policy and Fraud Guidance in line with fraud control best practice. We are committed to nurturing and promoting an anti-fraud culture, which is predicated on predicting, pre-empting and preventing fraud and misconduct affecting our organisation.

Fraud control

As a Corporate Commonwealth entity under the PGPA Act, we are required to comply with section 10 of the PGPA Rule. The Rule sets out the Australian Government's expectations in relation to fraud prevention, detection and response and sets a standard for the effective management of organisational fraud risks and fraud incidents. Our Fraud and Corruption Control Framework is accompanied by our Enterprise Risk Framework, policy and procedures, system, financial and internal controls, and other assurance and accountability practices, procedures and activities.

CSIRO Fraud Control has initiated a program to strengthen engagement with Commonwealth Agencies and Departments, including but not limited to the Australian Government Attorney-General's and the Commonwealth Fraud Prevention Centre. This initiative will further ensure the management of our Fraud Control Framework remains relevant, optimises external support opportunities and continues to mature throughout the organisation to a best practice standard.

Security

We recognise the Australian Government's Protective Security Policy Framework as our guide and use elements from this framework, as well as the Australian Government Information Security Manual, to inform our security frameworks. We continually review the organisation's risk appetite. Read more about our risk management on page 147.

We implement agreed management actions on protective security and will continue to do so through the endorsed Enterprise Security Program, including improvements on countering foreign interference, improving physical security to protect CSIRO people, assets and information.

We continue to embed cyber and information and communication technology security to support our strategy and to demonstrate to our customers that we are a trusted advisor.

The CSIRO Security Committee, a sub-committee of our Executive Team, ensures that we implement effective security strategies, programs and measures to protect our people, information and assets. It also guides the development and implementation of security infrastructure improvements and oversees our response to major security incidents. Read more about our security on page 122.

Reviews of outside bodies

The Senate Standing Committees on Economics examines our operations following the Federal Budget, the tabling of our annual report and the introduction to Parliament of the additional Appropriation Bills. This year, our senior executives appeared before the Committee during the Senate Estimates process on 3 occasions. The Committee reviewed our Annual Report 2019–20 and noted that they considered it to be fully compliant.

In June 2020, the Australian National Audit Office (ANAO) presented its independent performance audit report, *Implementation of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Property Investment Strategy* to Parliament. The Auditor-General made 5 recommendations to improve our monitoring and measurement, governance, risk management, reporting and performance targets. We have implemented responses to all the ANAO recommendations. Read more about these responses and our Property Strategy on page 122.

Judicial decisions

During 2020–21, there were no judicial decisions or decisions of administrative tribunals that have had, or may have had, a significant effect on our operations.

Service charter

Our service charter describes the standards of service we aim to deliver to our customers and our commitment to ensuring that these standards are maintained.

In summary:

- We believe our customers and partners are essential to our success.
- We maintain relevance in our work through input from the public, government, industry and the research community.
- We communicate with our customers in a courteous, helpful and professional manner.
- We respect customer confidentiality.
- We evaluate our services to ensure continuous improvement of our service delivery.

Our complete service charter is available on our website.

We welcome feedback on our performance. Contact the CSIRO officer with whom you have been dealing or CSIRO Enquiries, which can direct your feedback to the relevant person:

Private Bag 10, Clayton South VIC 3169
1300 363 400
csiro.au/contact

Administrative Law

Freedom of Information

The *Freedom of Information Act 1982 (FOI Act)* provides the public with a general right of access to documents held by Australian Government agencies, including CSIRO. The general right is limited by exceptions to protect essential public interests and the privacy or business affairs of those who give information to the agency. In the reporting year to 30 June, we received 71 requests for, or consultations on, documents under the FOI Act.

General information about our FOI procedures, including how to make an FOI request, is available on our website.

Part V of the FOI Act confers a right to request CSIRO to amend a document to which lawful access has been granted, where the applicant claims that information in the document:

- relates to his or her personal affairs
- is incomplete, incorrect, out of date or misleading
- has been used, is being used or is available for use by the agency or Minister for an administrative purpose.

During 2020–21, we received no requests for amendments of personal information under the FOI Act.

Information Publication Scheme

We are required to publish information to the public as part of the Information Publication Scheme. This requirement, in Part II of the FOI Act, replaces the former requirement to publish a section 8 statement in an annual report. We provide a plan on our website showing what information we publish in keeping with the Information Publication Scheme requirements.

Members of the public may access scientific and technical publications from CSIRO Publishing and the ePublish Repository. Research data used by CSIRO is routinely published on the CSIRO Data Access Portal.

Archives, privacy and administrative decisions

Our archives collection includes material from the Council for Science and Industrial Research, the predecessor of CSIRO, dating from 1926. In accordance with the *Archives Act 1983* (Cth) (Archives Act), certain CSIRO records are held by the National Archives of Australia. Disposal arrangements for CSIRO records follow the Archives Act, and access to records over 20 years old is provided in accordance with that Act.

We are bound by the Australian Privacy Principles under the *Privacy Act 1988* (the Privacy Act) and have various measures in place to manage compliance, including our Privacy Management Plan and Data Breach Response Plan. During 2020–21, as a courtesy we informed the Office of the Australian Information Commissioner (OAIC) of one data breach, noting that the breach was not notifiable to OAIC under the Notifiable Data Breaches Scheme.

The Administrative Decisions (Judicial Review) Act 1977 enables a person aggrieved by certain classes of administrative decisions made by Australian Government agencies, including CSIRO, to obtain reasons for or to challenge those decisions. During 2020–21, we received no challenges or requests for statements of reasons under the Act.

Contact

All enquiries under the above legislation (including FOI requests) should be directed to:

FOI Officer/Privacy Officer
CSIRO
GPO Box 1700
Canberra ACT 2601
02 6276 6431

FOI@csiro.au

Public Interest Disclosure

Internal procedures have been implemented to comply with the *Public Interest Disclosure Act 2013* (PID Act) through a Public Interest Disclosure Scheme (the PID Scheme).

The PID Scheme promotes integrity and accountability by encouraging the disclosure of information about suspected wrongdoing, protecting people who make disclosures and ensuring we take appropriate action. We have contributed to the Commonwealth Ombudsman's annual report on the PID, as required in section 76(3) of the Act. In 2020–21, we received 3 public interest disclosures pursuant to section 26 of the PID Act.

Consultancy services

We engage consultants where we lack specialist expertise or when independent research, review or assessment is required. Consultants are typically engaged to investigate or diagnose a defined issue or problem; carry out defined reviews or evaluations; or provide independent advice, information or creative solutions to assist in our decision-making.

Before engaging consultants, we consider the skills and resources required for the task, the skills available internally and the cost effectiveness of engaging external expertise. The decision to engage a consultant adheres to the Commonwealth Procurement Rules, CSIRO procurement procedures, the *Public Governance, Performance and Accountability Act 2013* and the CSIRO Delegations and Authorities Manual.

Our policy on selection and engagement of consultants is based on the principles of:

- value for money
- open and effective competition
- ethics and fair dealing
- accountability and reporting
- national competitiveness and industry development
- support for other Australian Government policies.

Tables 4.2, 4.3 and 4.4 summarise the consultancies let and the annual spend, the reason for the consultancy and the procurement method. All values include goods and services tax.

Table 4.2: Annual spend on consultancies

YEAR	SPENT ($)	LET ($) (ESTIMATED WHOLE OF LIFE)
2016–17	1,642,455	1,420,166
2017–18	1,561,210	1,625,863
2018–19	1,553,566	1,700,668
2019–20	1,690,411	1,856,563
2020–21	1,184,510	2,077,655

Table 4.3: Summary by reason code for 2020–21

CATEGORY CODE	REASON FOR CONSULTANCY	NUMBER OF CONSULTANCIES	VALUE ($)
IS	Need for independent study/evaluation	1	601,876
PA	Need for professional assistance to manage and facilitate change and its consequence	4	815,635
SS	Specialist skills were not otherwise available	9	660,144
Total		**14**	**2,077,655**

Table 4.4: Summary by procurement method code for 2020–21

CATEGORY CODE	PROCUREMENT METHOD	NUMBER OF CONSULTANCIES	VALUE ($)
OT	Tenders sought from the marketplace through Open Approach (Request for Proposal, Request for Tender, Expressions of Interest)	0	
PM	An existing panel member – this category includes standing offers, common use arrangements and approved supplier panels	12	2,059,859
ST	Tenders being sought from suppliers who have pre-qualified through some form of previous competitive process	0	
RQ	Purchasing was undertaken in accordance with Division 1 of the Commonwealth procurement rules (CPRs) and procurement did not require application of Division 2 of the CPRs	2	17,796
EX	Exemption applied that saw CSIRO undertake the procurement as a Limited Tender as defined in Division 2 of the CPRs	0	

Part 5
Financial statements

Australian National Audit Office

INDEPENDENT AUDITOR'S REPORT

To the Minister for Industry, Science and Technology

Opinion

In my opinion, the financial statements of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity for the year ended 30 June 2021:

(a) comply with Australian Accounting Standards – Reduced Disclosure Requirements and the *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015*; and

(b) present fairly the financial positions of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity as at 30 June 2021 and their financial performance and cash flows for the year then ended.

The financial statements of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity, which I have audited, comprise the following as at 30 June 2021 and for the year then ended:

- Statement by the Chairman of the Board, Chief Executive and Chief Finance Officer;
- Statement of Comprehensive Income;
- Statement of Financial Position;
- Statement of Changes in Equity;
- Cash Flow Statement; and
- Notes to and forming part of the financial statements.

Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of the Entity and the Consolidated Entity in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) to the extent that they are not in conflict with the *Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Accountable Authority's responsibility for the financial statements

As the Accountable Authority of the Commonwealth Scientific and Industrial Research Organisation, the Board is responsible under the *Public Governance, Performance and Accountability Act 2013* (the Act) for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the rules made under the Act. The Board is also responsible for such internal control as the Board determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board is responsible for assessing the ability of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity to continue as a going concern, taking into account whether the entities' operations will cease as a result of an administrative restructure or for any other reason. The Board is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

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38 Sydney Avenue FORREST ACT 2603
Phone (02) 6203 7300 Fax (02) 6203 7777

Auditor's responsibilities for the audit of the financial statements

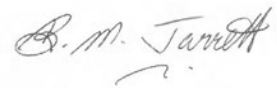
My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Entity and the Consolidated Entity's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Accountable Authority;
- conclude on the appropriateness of the Accountable Authority's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Entity or the Consolidated Entity's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Entity or the Consolidated Entity to cease to continue as a going concern;
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation; and
- obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Consolidated Entity to express an opinion on the financial report. I am responsible for the direction, supervision and performance of the Consolidated Entity audit. I remain solely responsible for my audit opinion.

I communicate with the Accountable Authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office



Brandon Jarrett

Senior Executive Director

Delegate of the Auditor-General

Canberra

1 September 2021

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION
Financial Statements

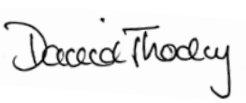
for the period ended 30 June 2021

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION
STATEMENT BY THE CHAIRMAN OF THE BOARD, CHIEF EXECUTIVE AND CHIEF FINANCE OFFICER

In our opinion, the attached financial statements for the period ended 30 June 2021 comply with subsection 42(2) of the Public Governance, Performance and Accountability Act 2013 (PGPA Act), and are based on properly maintained financial records as per subsection 41(2) of the PGPA Act.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and its subsidiaries will be able to pay their debts as and when they fall due.

This statement is made in accordance with a resolution of the directors.



David Thodey
Chairman of the Board
31 August 2021

Larry Marshall
Chief Executive and Board Member
31 August 2021

Tom Munyard
Chief Finance Officer
31 August 2021

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF COMPREHENSIVE INCOME
For the period ended 30 June 2021

		Consolidated		CSIRO	
		2021	2020	**2021**	2020
NET COST OF SERVICES	**Notes**	**$'000**	$'000	**$'000**	$'000
Expenses					
Employee benefits	1.1A	**748,839**	794,602	**744,397**	792,351
Suppliers	1.1B	**424,372**	433,420	**441,636**	427,919
Depreciation and amortisation	2.2A	**182,713**	182,830	**182,087**	182,233
Finance costs	1.1C	**2,308**	2,707	**2,273**	2,666
Write-downs and impairment loss on financial instruments	1.1D	**906**	1,304	**906**	895
Write-downs and impairment of other assets	1.1E	**7,340**	12,188	**7,340**	12,188
Loss on revaluation of investment properties		**356**	2,700	**356**	2,700
Losses from asset sales	1.1F	**3,402**	-	**3,402**	-
Foreign exchange losses		**809**	-	**811**	394
Total expenses		**1,371,045**	1,429,751	**1,383,208**	1,421,346
Own-Source Income					
Own-source revenue					
Revenue from contracts with customers	1.2A	**431,111**	449,419	**437,008**	462,735
Bank and term deposits interest	1.2B	**3,425**	5,772	**2,755**	4,251
Rental income	1.2C	**7,538**	9,200	**7,538**	9,200
Other revenues	1.2D	**15,426**	30,818	**13,514**	21,277
Total own-source revenue		**457,500**	495,209	**460,815**	497,463
Gains					
Gains from sale of equity investments and intellectual property		**2,600**	2,032	**2,581**	1,580
Gains from asset sales	1.1F	**-**	29,662	**-**	29,662
Gains on valuation of equity investments	4.2B	**119,961**	101,503	**19,905**	43,915
Other gains	1.2E	**16,255**	3,890	**16,255**	3,890
Foreign exchange gains		**-**	383	**-**	-
Total gains		**138,816**	137,470	**38,741**	79,047
Total own-source income		**596,316**	632,679	**499,556**	576,510
Net cost of services		**(774,729)**	(797,072)	**(883,652)**	(844,836)
Revenue from Government	1.2F	**960,537**	837,873	**960,537**	837,873
Surplus/(deficit)		**185,808**	40,801	**76,885**	(6,963)
OTHER COMPREHENSIVE INCOME					
Changes in asset revaluation reserves	1.3A	**49,496**	-	**49,496**	-
Changes in other reserves	1.3B	**(56)**	(176)	**-**	-
Total other comprehensive income		**49,440**	(176)	**49,496**	-
Total comprehensive income/(loss)		**235,248**	40,625	**126,381**	(6,963)
Surplus/(deficit) for the year is attributable to:					
Non-controlling interest		**58,876**	18,994	**-**	-
CSIRO		**126,932**	21,807	**76,885**	(6,963)
Total surplus/(deficit)		**185,808**	40,801	**76,885**	(6,963)
Total comprehensive income for the year is attributable to:					
Non-controlling interest		**58,876**	18,994	**-**	-
CSIRO		**176,372**	21,631	**126,381**	(6,963)
Total comprehensive income/(loss)		**235,248**	40,625	**126,381**	(6,963)

The above Statement should be read in conjunction with the accompanying notes.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF FINANCIAL POSITION
as at 30 June 2021

		Consolidated		CSIRO	
		2021	2020	**2021**	2020
	Notes	**$'000**	$'000	**$'000**	$'000
ASSETS					
Financial Assets					
Cash and cash equivalents	2.1A	**537,636**	403,496	**403,872**	302,619
Trade and other receivables	2.1B	**88,974**	88,945	**85,206**	89,936
Other investments	2.1C	**477,903**	304,490	**214,650**	177,467
Total financial assets		**1,104,513**	796,931	**703,728**	570,022
Non-Financial Assets[1]					
Land and buildings	2.2A	**1,618,408**	1,608,249	**1,617,712**	1,606,931
Heritage and cultural	2.2A	**9,952**	4,463	**9,952**	4,463
Plant and equipment	2.2A	**540,596**	559,183	**540,452**	559,009
Intangibles	2.2A	**19,716**	13,650	**19,716**	13,650
Investment properties	2.2B	**49,016**	49,373	**49,016**	49,373
Inventories		**1,315**	1,420	**1,315**	1,420
Other non-financial assets	2.2C	**12,416**	18,748	**12,371**	18,803
Total non-financial assets		**2,251,419**	2,255,086	**2,250,534**	2,253,649
Properties held for sale		**5,200**	5,200	**5,200**	5,200
Total assets		**3,361,132**	3,057,217	**2,959,462**	2,828,871
LIABILITIES					
Payables					
Suppliers	2.3A	**218,014**	215,021	**213,989**	210,200
Other payables	2.3B	**16,034**	17,796	**15,716**	18,601
Deposits	2.3C	**21,800**	22,508	**23,469**	25,588
Total payables		**255,848**	255,325	**253,174**	254,389
Interest Bearing Liabilities					
Lease liabilities	2.4	**81,016**	116,740	**80,293**	115,371
Total Interest bearing liabilities		**81,016**	116,740	**80,293**	115,371
Provisions					
Employee provisions	3.1A	**264,700**	262,913	**264,483**	262,729
Provision for remediation	2.5	**62,776**	40,457	**62,776**	40,457
Total provisions		**327,476**	303,370	**327,259**	303,186
Total liabilities		**664,340**	675,435	**660,726**	672,946
Net assets		**2,696,792**	2,381,782	**2,298,736**	2,155,925
EQUITY					
Contributed equity		**327,384**	310,954	**327,076**	310,646
Asset revaluation reserves		**1,572,725**	1,523,229	**1,572,725**	1,523,229
Other reserves		**(259)**	(203)	**-**	-
Retained surplus		**582,925**	455,993	**398,935**	322,050
Non-controlling interest		**214,017**	91,809	**-**	-
Total equity		**2,696,792**	2,381,782	**2,298,736**	2,155,925

The above Statement should be read in conjunction with the accompanying notes.

[1]Right-of-use ('ROU') assets are included in Land and buildings and Plant and equipment.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF CHANGES IN EQUITY – CONSOLIDATED
For the period ended 30 June 2021

	Retained earnings		Asset revaluation reserve		Other reserves		Contributed equity/capital		Non-controlling interest		Total equity	
	2021	2020	**2021**	2020	**2021**	2020	**2021**	2020	**2021**	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000
Opening balance	**455,993**	435,198	**1,523,229**	1,523,229	**(203)**	(27)	**310,954**	300,954	**91,809**	39,839	**2,381,782**	2,299,193
Adjustment on initial application of AASB 15/AASB 1058	**-**	(1,012)	**-**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	(1,012)
Adjusted opening balance	**455,993**	434,186	**1,523,229**	1,523,229	**(203)**	(27)	**310,954**	300,954	**91,809**	39,839	**2,381,782**	2,298,181
Comprehensive income												
Other comprehensive income[1]	**-**	-	**49,496**	-	**(56)**	(176)	**-**	-	**-**	-	**49,440**	(176)
Surplus/(deficit) for the period	**126,932**	21,807	**-**	-	**-**	-	**-**	-	**58,876**	18,994	**185,808**	40,801
Total comprehensive income/(loss)	**126,932**	21,807	**49,496**	-	**(56)**	(176)	**-**	-	**58,876**	18,994	**235,248**	40,625
Other movements	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Contributions by owners												
Equity injection	**-**	-	**-**	-	**-**	-	**16,430**	10,000	**63,332**	32,976	**79,762**	42,976
Contributions by owners – other	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Closing balance	**582,925**	455,993	**1,572,725**	1,523,229	**(259)**	(203)	**327,384**	310,954	**214,017**	91,809	**2,696,792**	2,381,782

The above Statement should be read in conjunction with the accompanying notes.

[1] Refer to Note 1.3.

Accounting Policy

Equity Injections

Amounts that are designated as equity injections for a year are recognised directly in contributed equity in that year.

Non-controlling interests

Non-controlling interests refer to equity in a subsidiary that is not attributable (directly or indirectly) to CSIRO as parent. CSIRO recognises non-controlling interests in the CSIRO Innovation Fund subsidiary entities.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF CHANGES IN EQUITY – CSIRO
For the period ended 30 June 2021

	Retained earnings		Asset revaluation reserve		Contributed equity/capital		Total equity	
	2021	2020	**2021**	2020	**2021**	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000
Opening balance	**322,050**	331,943	**1,523,229**	1,523,229	**310,646**	300,646	**2,155,925**	2,155,818
Adjustment on initial application of AASB 15/AASB 1058	**-**	(2,930)	**-**	-	**-**	-	**-**	(2,930)
Adjusted opening balance	**322,050**	329,013	**1,523,229**	1,523,229	**310,646**	300,646	**2,155,925**	2,152,888
Comprehensive income								
Other comprehensive income[1]	**-**	-	**49,496**	-	**-**	-	**49,496**	-
Surplus/(deficit) for the period	**76,885**	(6,963)	**-**	-	**-**	-	**76,885**	(6,963)
Total comprehensive income/(loss)	**76,885**	(6,963)	**49,496**	-	**-**	-	**126,381**	(6,963)
Other movements	**-**	-	**-**	-	**-**	-	**-**	-
Contributions by owners								
Equity injection	**-**	-	**-**	-	**16,430**	10,000	**16,430**	10,000
Contributions by owners – other	**-**	-	**-**	-	**-**	-	**-**	-
Closing balance	**398,935**	322,050	**1,572,725**	1,523,229	**327,076**	310,646	**2,298,736**	2,155,925

The above Statement should be read in conjunction with the accompanying notes.

[1]Refer to Note 1.3.

Accounting Policy

Equity Injections

Amounts that are designated as equity injections for a year are recognised directly in contributed equity in that year.

Non-controlling interests

Non-controlling interests refer to equity in a subsidiary that is not attributable (directly or indirectly) to CSIRO as parent. CSIRO recognises non-controlling interests in the CSIRO Innovation Fund subsidiary entities.

CONSOLIDATED FINANCIAL STATEMENTS
CASH FLOW STATEMENT
For the period ended 30 June 2021

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
OPERATING ACTIVITIES				
Cash received				
Receipts from Government	**960,537**	837,873	**960,537**	837,873
Sale of goods and rendering of services	**506,929**	573,857	**516,630**	571,706
Interest	**3,181**	6,563	**2,253**	4,676
Net GST received	**13,807**	21,203	**13,134**	21,235
Total cash received	**1,484,454**	1,439,496	**1,492,554**	1,435,490
Cash used				
Employees	**743,647**	765,251	**739,381**	763,146
Suppliers	**460,127**	520,701	**477,567**	513,555
Interest payments on lease liabilities	**2,178**	2,585	**2,154**	2,573
Finance costs	**130**	122	**119**	93
Deposits	**708**	799	**2,119**	1,773
Total cash used	**1,206,790**	1,289,458	**1,221,340**	1,281,140
Net cash from operating activities	**277,664**	150,038	**271,214**	154,350
INVESTING ACTIVITIES				
Cash received				
Proceeds from sales of property, plant and equipment	**-**	90,547	**-**	90,547
Proceeds from sales of equity investments and intellectual property	**2,675**	6,842	**2,656**	6,390
Total cash received	**2,675**	97,389	**2,656**	96,937
Cash used				
Purchase of property, plant and equipment	**137,746**	103,765	**137,708**	103,634
Equity investments	**48,141**	61,907	**11,911**	12,942
Other selling costs	**29**	1,397	**29**	1,397
Losses from sales of property, plant and equipment	**4,321**	-	**4,321**	-
Total cash used	**190,237**	167,069	**153,969**	117,973
Net cash used in investing activities	**(187,562)**	(69,680)	**(151,313)**	(21,036)
FINANCING ACTIVITIES				
Cash received				
Contributed equity	**79,762**	42,976	**16,430**	10,000
Total cash received	**79,762**	42,976	**16,430**	10,000
Cash used				
Principal payments of lease liabilities	**35,724**	39,913	**35,078**	39,524
Total cash used	**35,724**	39,913	**35,078**	39,524
Net cash from financing activities	**44,038**	3,063	**(18,648)**	(29,524)
Net increase (decrease) in cash held	**134,140**	83,421	**101,253**	103,790
Cash and cash equivalents at the beginning of the reporting period	**403,496**	320,075	**302,619**	198,829
Cash and cash equivalents at the end of the reporting period	**537,636**	403,496	**403,872**	302,619

The above Statement should be read in conjunction with the accompanying notes.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

Overview

Objectives of CSIRO and its Subsidiaries (the Group)

CSIRO is an Australian Government controlled not-for-profit entity and is classified as a Corporate Commonwealth entity under the *Public Governance, Performance and Accountability Act 2013*. CSIRO is a research enterprise that aims to deliver great science and innovative solutions for industry, society and the environment, together with its subsidiaries ('referred to as 'the Group').

CSIRO is structured to meet the following outcome:

> Innovative scientific and technological solutions to national challenges and opportunities to benefit industry, the environment and the community, through scientific research and capability development, services and advice.

The continued existence of CSIRO in its present form and with its present programs is dependent on Government policy and on continued funding by Parliament for CSIRO's administration and programs.

The Basis of Preparation

The financial statements are required by section 42 of the *Public Governance, Performance and Accountability Act 2013* and are general purpose financial statements.

CSIRO and the Group's Consolidated Financial Statements have been prepared in accordance with:

- *Public Governance, Performance and Accountability (Financial Reporting Rule) 2015* (FRR); and
- *Australian Accounting Standards and Interpretations – Reduced Disclosure Requirements* issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and in accordance with the historical cost convention, except for certain assets and liabilities at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position.

The financial statements are presented in Australian dollars and values are rounded to the nearest thousand dollars unless otherwise specified.

Key Judgements and Estimates

In the process of applying the Group's accounting policies, management has made a number of judgements and applied estimates and assumptions to future events. Information around judgements and estimates which are material to the financial statements are found in the following notes:

- Note 2.5 Provision for Remediation
- Note 3.1A Employee Provisions
- Note 4.3A Fair Value Measurement

Consolidation

The consolidated financial statements comprise the financial statements of the CSIRO and its subsidiaries. The subsidiaries of CSIRO are the Science and Industry Endowment Fund (SIEF), the CSIRO Chile Research Fundación (Fundación), National ICT Australia (NICTA), the Innovation Fund and the US Office. Refer to Note 3.4 for further information.

The consolidated financial statements incorporate the assets and liabilities of all entities controlled by CSIRO as at 30 June 2021 and the results of the controlled entities for the year then ended. Subsidiaries are consolidated from the date on which control is obtained through to the date on which control ceases. The Group applies consistent accounting policies and the effects of all transactions and balances between the entities are eliminated in full.

The non-controlling interest in the results and equity of subsidiaries is shown separately in the statement of comprehensive income, statement of financial position and statement of changes in equity of the consolidated Group.

Foreign Currency Translation

The functional currency of CSIRO and its Australian subsidiaries is Australian dollars. The Group has three overseas subsidiary entities, the Fundación and the US Office entities, with their functional currency being Peso CLP and US dollars respectively. On consolidation, those entities:

- Assets and liabilities are translated into Australian dollars at the rate of exchange prevailing at the reporting date; and
- The statement of comprehensive income is translated at average exchange rate.

The exchange rate differences arising are recognised in the net cost of services.

New Australian Accounting Standards

All new, revised and/or amending standards and/or interpretations that were issued prior to the signing of these statements and are applicable to the current reporting period did not have a material effect on the financial statements of the Group. There has been no early adoption of accounting standards applicable to future years.

Taxation

In accordance with Section 53 of the *Science and Industry Research Act 1949*, CSIRO is exempt from all forms of Australian taxation except the fringe benefits tax (FBT) and the goods and services tax (GST). The Group pays applicable taxes in overseas countries.

Revenues, expenses, assets and liabilities are recognised net of GST except:

- where the amount of GST incurred is not recoverable from the Australian Taxation Office; and
- for receivables and payables.

The SIEF is exempt from income tax in Australia. The Innovation Fund entities are subject to all applicable taxes in Australia. The Fundación is subject to all applicable taxes in Chile. The US Office is subject to taxes in the United States. NICTA is exempt from income tax however NICTA's subsidiaries (including NICTA IPR Pty Ltd) are subject to applicable taxes in Australia. The amounts of income and other tax payable by the Group's subsidiaries is not material to the consolidated statements.

Prior Period Error

The 2019-20 financial statements contained a misstatement within the accounts due to an error in the consolidation of the Group's controlled entities. The misstatement was not considered material and corrected in 2020-21 through the gain/loss on valuation of equity investments in the statement of comprehensive income. The impact on the prior year balances was an overstatement of other investments of $19.8m, overstatement of retained surplus of $3.3m, an overstatement of gain/(loss) on valuation of equity investments of $17.3m and an understatement of foreign exchange gains $0.8m.

Events after the Reporting Period

At the time of signing of the financial statements, the Group is not aware of any significant events occurring after the reporting date.

Future Events

CSIRO is exploring future commercial opportunities for the Ginninderra Field Station, a 701 hectare area of land which CSIRO owns in north Canberra. Due to rapid urban growth in the surrounding area, the site has become under-utilised and the field station has been relocated to a more rural setting. As part of its focus on exploring the future possibilities for this site, CSIRO has successfully requested the National Capital Authority (NCA) to include the site as 'Urban Area' on the General Policy Plan for Metropolitan Canberra in the National Capital Plan draft Amendment 86. The Amendment became effective in November 2016.

This initial step in rezoning the land has allowed CSIRO to explore avenues to divest the Ginninderra land in a commercially beneficial way. The CSIRO proposes to divest Ginninderra east via a conditional sale. The conditions on the sale are necessary to meet community expectations that the land will be developed with a significant component of sustainability. As this progresses, it is expected that there will be a material increase in the recorded value of the Ginninderra land.

1. Financial Performance

This section analyses the financial performance of CSIRO for the year ended 30 June 2021.

1.1. Expenses

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 1.1A: Employee Benefits				
Wages and salaries	**573,254**	594,433	**567,678**	590,762
Superannuation				
Defined contribution plans	**53,158**	53,661	**53,158**	53,661
Defined benefit plans	**41,880**	43,933	**41,790**	43,839
Leave and other entitlements	**72,910**	96,659	**72,715**	96,468
Separation and redundancies	**17,764**	11,538	**17,764**	11,538
Gross employee benefits	**758,966**	800,224	**753,105**	796,268
Less:				
Employee cost recovery	**(10,127)**	(5,622)	**(8,708)**	(3,917)
Total employee benefits	**748,839**	794,602	**744,397**	792,351

Accounting Policy

Accounting policy for employee related expenses is contained in Section 3. People and Relationships.

Note 1.1B: Suppliers				
Goods supplied	**119,567**	91,264	**119,040**	91,037
Services rendered	**297,022**	333,672	**314,942**	328,513
Total goods and services supplied or rendered	**416,589**	424,936	**433,982**	419,550
Other suppliers				
Short-term leases and leases of low-value assets	**3,431**	4,902	**3,367**	4,811
Workers compensation expenses	**4,352**	3,582	**4,287**	3,558
Total other suppliers	**7,783**	8,484	**7,654**	8,369
Total Suppliers	**424,372**	433,420	**441,636**	427,919

CSIRO has short-term and low-value lease commitments of $2.74m as at 30 June 2021.

The above lease disclosures should be read in conjunction with the accompanying notes 1.1C, 1.2C, 2.2A and 2.4.

Accounting Policy

Short-term leases and leases of low-value assets

The Group has elected not to recognise right-of-use assets and lease liabilities for leases of assets that have a lease term of 12 months or less or leases of low-value assets (less than $10,000). The Group recognises the lease payments associated with these leases as an expense on a straight-line basis over the lease term.

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 1.1C: Finance Costs				
Interest on lease liabilities	**2,178**	2,585	**2,154**	2,573
Other interest payments	**130**	122	**119**	93
Total Finance costs	**2,308**	2,707	**2,273**	2,666

The above lease disclosures should be read in conjunction with the accompanying notes 1.1B, 1.2C, 2.2A and 2.4.

Note 1.1D: Write-downs and impairment loss on financial instruments				
Asset write-downs and impairments from:				
Bad debts written off	**272**	659	**272**	659
Allowance for impairment of trade and other receivables	**634**	645	**634**	236
Total write-downs and impairments on financial instruments	**906**	1,304	**906**	895
Note 1.1E: Write-downs and impairment of other assets				
Asset write-downs and impairments from:				
Property, plant and equipment	**7,340**	12,188	**7,340**	12,188
Total write-downs and impairment of other assets	**7,340**	12,188	**7,340**	12,188
Note 1.1F: Gain/(loss) from asset sales				
Land and buildings				
Proceeds from sale	**-**	90,000	**-**	90,000
Carrying value of assets sold	**-**	(56,264)	**-**	(56,264)
Selling expense	**-**	(1,375)	**-**	(1,375)
Net gain/(loss) from sale of land and buildings	**-**	32,361	**-**	32,361
Plant and equipment				
Proceeds from sale	**1,116**	399	**1,116**	399
Carrying value of assets sold	**(4,489)**	(3,076)	**(4,489)**	(3,076)
Selling expense	**(29)**	(22)	**(29)**	(22)
Net gain/(loss) from sale of plant and equipment	**(3,402)**	(2,699)	**(3,402)**	(2,699)
Total gain/(loss) from asset sales	**(3,402)**	29,662	**(3,402)**	29,662

1.2. Revenue and Gains

Own Source Revenue

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 1.2A: Revenue from contracts with customers				
Sale of goods	**11,890**	14,494	**11,890**	14,494
Rendering of services	**380,305**	406,341	**386,202**	419,657
Royalties and licence fees	**38,916**	28,584	**38,916**	28,584
Total revenue from contracts with customers	**431,111**	449,419	**437,008**	462,735

Disaggregation of revenue from contracts with customers

CSIRO derives its revenue under AASB 15 *Revenue from Contracts with Customers* from two main sources, being the sale of goods and rendering of services. Revenue has been disaggregated based on the line of business and further disaggregated based on the types of contracts that exist within the line of business. This disaggregation is considered most appropriate as it enables users of the Group's financial statements to understand the nature, timing and uncertainty of income and cash flows.

Revenue from contracts with customers - line of business:				
Impact Science				
Coinvestment	**209,386**	242,697	**215,283**	256,015
Consulting & Services	**63,671**	59,049	**63,671**	59,049
Licensing	**38,491**	28,161	**38,491**	28,159
Total Impact Science	**311,548**	329,907	**317,445**	343,223
National Facilities & Collections				
Coinvestment	**47,686**	52,597	**47,686**	52,597
Consulting & Services	**36,531**	34,867	**36,531**	34,867
Licensing	**354**	283	**354**	283
Total National Facilities & Collections	**84,571**	87,747	**84,571**	87,747
CSIRO Services				
Coinvestment	**9,329**	10,937	**9,329**	10,937
Consulting & Services	**17,212**	15,527	**17,212**	15,527
Licensing	**72**	139	**72**	139
Publishing revenue	**2,351**	1,731	**2,351**	1,731
Total CSIRO Services	**28,964**	28,334	**28,964**	28,334
Enterprise Support Services				
Coinvestment	**4,609**	2,071	**4,609**	2,071
Consulting & Services	**1,419**	1,360	**1,419**	1,360
Total Enterprise Support Services	**6,028**	3,431	**6,028**	3,431
Total	**431,111**	449,419	**437,008**	462,735

Accounting Policy

Revenue from the sale of goods is recognised when control has been transferred to the buyer. A contract falls within the scope of AASB 15 *Revenue from Contracts with Customers* when the criteria for accounting for a contract with a customer is met as per paragraph 9 of the standard. Performance obligations are required by an enforceable contract with the satisfaction of these performance obligations either measured over time or a point in time.

Disaggregation	Nature	Timing
Coinvestment	CSIRO conducts research and facilitates the uptake of scientific technology solutions with a partner or customer to deliver a positive impact to Australia.	Performance obligations are typically satisfied over time, as the customer simultaneously receives and consumes the benefits associated with CSIRO conducting scientific research or CSIRO is creating/enhancing an asset (usually Intellectual Property) that an end customer controls as the asset is created or enhanced. The progress towards the completion of a performance obligation are typically measured using either milestones reached or time elapsed. In the absence of an observable output method, an input method is used to measure the progress towards the completion of the performance obligations.
Consulting & Services	Consulting services are where CSIRO applies existing research to a customer's data or assets to enhance the customer's intellectual property or processes. CSIRO is a provider of a range of specialised laboratories, scientific and testing equipment, and other research facilities. Services revenue includes facility management fees, and testing and calibrations services.	Performance obligations are satisfied at a point in time or over time depending on the nature of services provided. The methods used to measure the progress towards completion of a performance obligation are dependent on the services provided and generally follow either a milestones reached to time elapsed assessment.
Royalties & Licensing	CSIRO provides a license to a customer which gives the customer a right to access or a right to use CSIRO intellectual property.	If the licence provides the customer with the right to access CSIRO intellectual property as it exists throughout the license period, performance obligations are satisfied and revenue recognised over time. If the license provides the customer with the right to use CSIRO intellectual property when the license is granted, performance obligations and revenue is recognised at a point in time.
Publishing revenue	CSIRO Publishing publishes and distributes scientific, technical and health science books, magazines and journals from Australia to a worldwide audience.	Performance obligations are satisfied at a point in time as the customer purchases and receives the goods.

The transaction price is the total amount of consideration to which CSIRO expects to be entitled in exchange for transferring promised goods or services to a customer. The consideration promised in a contract with a customer may include fixed amounts, variable amounts or both. Payment terms are specified in contracts, but are generally 30 days after the customer has been billed.

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 1.2B: Bank and term deposits interest				
Bank and term deposits	**3,425**	5,772	**2,755**	4,251

Accounting Policy

Interest revenue is recognised using the effective interest method as set out in AASB 9 *Financial Instruments*.

Note 1.2C: Rental Income				
Operating lease				
Lease income	**7,538**	9,200	**7,538**	9,200
Total Rental Income	**7,538**	9,200	**7,538**	9,200

Operating Leases

CSIRO has operating lease income receivables from the sub-leasing of offices and scientific research accommodation. The amounts below are GST inclusive.

Maturity analysis of operating lease income receivables

	Consolidated 2021 $'000	CSIRO 2021 $'000
Within 1 year	**6,468**	**6,468**
One to two years	**1,856**	**1,856**
Two to three years	**1,650**	**1,650**
Three to four years	**1,107**	**1,107**
Four to five years	**707**	**707**
More than 5 years	**1,871**	**1,871**
Total undiscounted lease payment receivable	**13,659**	**13,659**

The above lease disclosure should be read in conjunction with the accompanying notes 1.1B, 1.1C, 2.2A and 2.4.

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 1.2D: Other revenues				
Sale of primary produce	**1,153**	1,044	**1,153**	1,044
Donation	**337**	196	**337**	196
Capital contributions	**8,963**	9,349	**8,963**	9,349
Education programs and subscriptions	**132**	266	**132**	266
Other	**4,841**	19,963	**2,929**	10,422
Total other revenues	**15,426**	30,818	**13,514**	21,277

Accounting Policy

Other includes the sale of CSIRO publications and products, conferences and funding for costs of suppliers and external service providers.

Note 1.2E: Other gains				
Insurance proceeds	**9,936**	-	**9,936**	-
Assets received free of charge	**6,319**	3,890	**6,319**	3,890
Total other gains	**16,255**	3,890	**16,255**	3,890

Accounting Policy

Assets Received Free of Charge

Contributions of assets at no cost of acquisition or for nominal consideration are recognised as gains at their fair value when the asset qualifies for recognition, unless received from another Government entity as a consequence of a restructuring of administrative arrangements.

Note 1.2F: Revenue from Government				
Corporate Commonwealth Entity payment	**960,537**	837,873	**960,537**	837,873

Accounting Policy

Revenues from Government

Revenues from government are received from the Australian Government Department of Industry and Science (appropriated to CSIRO as a corporate commonwealth entity payment item).

1.3. Other Comprehensive Income

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Items that will not be classified to Net cost of services				
Note 1.3A: Change in asset revaluation reserves				
Revaluation of land and buildings	**50,807**	-	**50,807**	-
Revaluation of plant and equipment	**-**	-	**-**	-
Revaluation of heritage and cultural assets	**(1,311)**	-	**(1,311)**	-
Net increase/(decrease) in asset revaluation reserves	**49,496**	-	**49,496**	-
Items that may be reclassified to Net cost of services				
Note 1.3B: Change in other reserves				
Net change arising from foreign exchange movements on conversion of subsidiary accounts	**(56)**	(176)	**-**	-
Net increase/(decrease) in other reserves	**(56)**	(176)	**-**	-

2. Financial Position

This section analyses CSIRO's assets used to generate financial performance and the operating liabilities incurred as a result.

Employee related information is disclosed in the People and Relationships section.

2.1. Financial Assets

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 2.1A: Cash and Cash equivalents				
Cash at bank and on hand	**298,586**	371,496	**211,872**	270,619
Term deposits	**239,050**	32,000	**192,000**	32,000
Total cash and cash equivalents	**537,636**	403,496	**403,872**	302,619

Accounting Policy

Cash is recognised at its nominal value. Cash and cash equivalents includes:

a) cash on hand;

b) demand deposits in bank accounts with an original maturity of 3 months or less that are readily convertible to known amounts of cash and subject to insignificant risk of changes in value.

Note 2.1B: Trade and other receivables				
Goods and services receivable				
Goods and services	**54,053**	56,292	**50,634**	55,581
Interest	**735**	491	**565**	63
Contract assets	**25,924**	31,853	**25,924**	31,853
GST receivable	**5,437**	-	**5,328**	-
Other receivables	**3,924**	1,399	**3,444**	3,120
Total trade and other receivables (gross)	**90,073**	90,035	**85,895**	90,617
Less: impairment loss allowance for trade and other receivables	**(1,099)**	(1,090)	**(689)**	(681)
Total trade and other receivables (net)	**88,974**	88,945	**85,206**	89,936
Trade and other receivables (gross) aged as follows				
Not overdue	**79,450**	76,620	**75,272**	77,202
Overdue by				
0 to 30 days	**5,920**	6,460	**5,920**	6,460
31 to 60 days	**1,194**	2,620	**1,194**	2,620
61 to 90 days	**1,329**	1,589	**1,329**	1,589
More than 90 days	**2,180**	2,746	**2,180**	2,746
Total receivables (gross)	**90,073**	90,035	**85,895**	90,617
Reconciliation of impairment loss allowance				
Opening balance	**1,090**	445	**681**	445
Increase /(decrease) recognised in net surplus	**9**	645	**8**	236
Closing balance	**1,099**	1,090	**689**	681

Contract assets are associated with services that have been transferred to the customer by CSIRO but there are remaining services to be performed in order to invoice the customer.

Accounting Policy

Financial assets

Trade receivables, loans and other receivables that are held for the purpose of collecting the contractual cash flows where the cash flows are solely payments of principal and interest, that are not provided at below-market interest rates, are subsequently measured at amortised cost using the effective interest method adjusted for any loss allowance. Receivables for goods and services, which have 30 day terms, are recognised at the nominal amounts due less any impairment.

Accounting Policy (cont'd)

Impairment of Financial assets

The simplified approach for trade, contract and lease receivables is used. This approach always measures the loss allowance as the amount equal to the lifetime expected credit losses. A write-off constitutes a de-recognition event where the write off directly reduces the gross carrying amount of the financial asset.

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 2.1C: Other Investments				
Listed companies	**16,464**	13,063	**16,464**	13,063
Unlisted companies	**123,448**	98,828	**107,681**	84,941
Innovation Fund	**328,148**	183,723	**80,662**	70,587
Uniseed Investment	**9,843**	8,876	**9,843**	8,876
Total investments	**477,903**	304,490	**214,650**	177,467

Accounting Policy

CSIRO has investments in a number of unlisted start-up companies over which it does not have significant influence or control. These companies have been established for the purpose of commercialisation of CSIRO's intellectual property. CSIRO also has some investments in companies which have been listed on the Australian Stock Exchange and in the Uniseed trust. CSIRO, as part of the National Innovation and Science Agenda, has also established and invested in an Innovation Fund to invest in the development of early stage technology opportunities. Refer to Note 3.4 Related Party Disclosures for more information.

CSIRO's other investments are accounted for in accordance with AASB 9 *Financial Instruments*. See note 4.2 and 4.3 for further information.

2.2. Non-Financial Assets

Note 2.2A: Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles

(a) Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles for 2021 - Consolidated

	Land $'000	Buildings $'000	Total land and buildings $'000	Plant and equipment $'000	Heritage and cultural $'000	Intangibles $'000	Total $'000
As at 1 July 2020							
Gross book value	**386,600**	**2,817,200**	**3,203,800**	**1,341,527**	**13,997**	**52,628**	**4,611,952**
Accumulated depreciation and amortisation	**-**	**(1,595,551)**	**(1,595,551)**	**(782,344)**	**(9,534)**	**(38,978)**	**(2,426,407)**
Net book value as at 1 July 2020	**386,600**	**1,221,649**	**1,608,249**	**559,183**	**4,463**	**13,650**	**2,185,545**
Additions:							
By purchase	**5,026**	**64,188**	**69,214**	**63,196**	**-**	**5,337**	**137,747**
Right-of-use assets	**-**	**8,971**	**8,971**	**1,073**	**-**	**-**	**10,044**
Assets first recognised through a gain in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Reclassification	**(8,500)**	**7,314**	**(1,186)**	**(9,027)**	**6,800**	**3,413**	**-**
Revaluations recognised in other comprehensive income	**28,560**	**22,247**	**50,807**	**-**	**(1,311)**	**-**	**49,496**
Impairments recognised in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Write-offs and impairments on right-of-use assets recognised in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Depreciation expense	**-**	**(69,262)**	**(69,262)**	**(68,817)**	**-**	**(2,535)**	**(140,614)**
Depreciation on right-of-use assets	**-**	**(41,132)**	**(41,132)**	**(967)**	**-**	**-**	**(42,099)**
Total depreciation and amortisation	**-**	**(110,394)**	**(110,394)**	**(69,784)**	**-**	**(2,535)**	**(182,713)**
Disposals	**-**	**(2,199)**	**(2,199)**	**(4,044)**	**-**	**(149)**	**(6,392)**
Disposals of Right-of-Use Assets	**-**	**(5,054)**	**(5,054)**	**(1)**	**-**	**-**	**(5,055)**
Net book value as at 30 June 2021	**411,686**	**1,206,722**	**1,618,408**	**540,596**	**9,952**	**19,716**	**2,188,672**
Net book value as at 30 June 2021 represented by:							
Gross book value	**411,686**	**3,032,053**	**3,443,739**	**1,224,482**	**150,061**	**60,808**	**4,879,090**
Accumulated depreciation and amortisation	**-**	**(1,825,331)**	**(1,825,331)**	**(683,886)**	**(140,109)**	**(41,092)**	**(2,690,418)**
Total as at 30 June 2021	**411,686**	**1,206,722**	**1,618,408**	**540,596**	**9,952**	**19,716**	**2,188,672**
Carrying amount of right-of-use assets	**-**	**152,010**	**152,010**	**2,214**	**-**	**-**	**154,224**

All revaluations were conducted in line with the revaluation policy stated with this note. An independent valuer conducted the revaluations as at 30 June 2021.

(b) Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles for 2021 - CSIRO

	Land $'000	Buildings $'000	Total land and buildings $'000	Plant and equipment $'000	Heritage and cultural $'000	Intangibles $'000	Total $'000
As at 1 July 2020							
Gross book value	**386,600**	**2,815,421**	**3,202,021**	**1,340,678**	**13,997**	**52,628**	**4,609,324**
Accumulated depreciation and amortisation	**-**	**(1,595,090)**	**(1,595,090)**	**(781,669)**	**(9,534)**	**(38,978)**	**(2,425,271)**
Net book value as at 1 July 2020	**386,600**	**1,220,331**	**1,606,931**	**559,009**	**4,463**	**13,650**	**2,184,053**
Additions							
By purchase	**5,026**	**64,188**	**69,214**	**63,158**	**-**	**5,337**	**137,709**
Right-of-use assets	**-**	**8,971**	**8,971**	**1,073**	**-**	**-**	**10,044**
Assets first recognised through a gain in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Reclassification	**(8,500)**	**7,314**	**(1,186)**	**(9,027)**	**6,800**	**3,413**	**-**
Revaluations recognised in other comprehensive income	**28,560**	**22,247**	**50,807**	**-**	**(1,311)**	**-**	**49,496**
Impairments recognised in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Write-offs and impairments on right-of-use assets recognised in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Depreciation expense	**-**	**(69,262)**	**(69,262)**	**(68,750)**	**-**	**(2,535)**	**(140,547)**
Depreciation on right-of-use assets	**-**	**(40,573)**	**(40,573)**	**(967)**	**-**	**-**	**(41,540)**
Total depreciation and amortisation	**-**	**(109,835)**	**(109,835)**	**(69,717)**	**-**	**(2,535)**	**(182,087)**
Disposals	**-**	**(2,199)**	**(2,199)**	**(4,044)**	**-**	**(149)**	**(6,392)**
Disposals of Right-of-Use Assets	**-**	**(4,991)**	**(4,991)**	**-**	**-**	**-**	**(4,991)**
Net book value as at 30 June 2021	**411,686**	**1,206,026**	**1,617,712**	**540,452**	**9,952**	**19,716**	**2,187,832**
Net book value as at 30 June 2021 represented by:							
Gross book value	**411,686**	**3,030,493**	**3,442,179**	**1,223,594**	**150,061**	**60,808**	**4,876,642**
Accumulated depreciation and amortisation	**-**	**(1,824,467)**	**(1,824,467)**	**(683,142)**	**(140,109)**	**(41,092)**	**(2,688,810)**
Total as at 30 June 2021	**411,686**	**1,206,026**	**1,617,712**	**540,452**	**9,952**	**19,716**	**2,187,832**
Carrying amount of right-of-use assets	**-**	**151,314**	**151,314**	**2,214**	**-**	**-**	**153,528**

All revaluations were conducted in line with the revaluation policy stated with this note. An independent valuer conducted the revaluations as at 30 June 2021.

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Contractual commitments for fixed assets:				
Capital commitments comprise outstanding payments for buildings under construction and commitments for purchase of plant and equipment. Commitments are reported inclusive of GST.				
Land and buildings	**55,088**	25,751	**55,088**	25,751
Plant and equipment	**6,366**	12,999	**6,366**	12,999
Total commitments payable	**61,454**	38,750	**61,454**	38,750
Within 1 year	**51,079**	29,638	**51,079**	29,638
Between 1 to 5 years	**10,375**	7,464	**10,375**	7,464
More than 5 years	**-**	1,648	**-**	1,648
Total commitments payable	**61,454**	38,750	**61,454**	38,750

Accounting Policy

Acquisition of Assets

Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes the fair value of assets transferred in exchange and liabilities undertaken. Assets acquired at no cost or for nominal considerations are initially recognised as assets and revenues at their fair value at the date of acquisition.

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost in the Statement of Financial Position, except for purchases costing less than $5,000, which are expensed in the year of acquisition (other than where they form part of a group of similar items which are significant in total).

Lease Right of Use (ROU) Assets

Leased ROU assets are capitalised at the commencement date of the lease and comprise of the initial lease liability amount, initial direct costs incurred when entering into the lease less any lease incentives received. These assets are accounted for by CSIRO as separate asset classes to corresponding assets owned outright, but included in the same column as where the corresponding underlying assets would be presented if they were owned.

Revaluations

Following initial recognition at cost, property, plant and equipment (excluding intangibles and ROU assets) are carried at fair value less accumulated depreciation and accumulated impairment losses. Valuations are conducted with sufficient frequency to ensure the carrying amount of assets do not differ materially from the assets' fair value as at reporting date. Valuations are conducted every three years for assets that fall within the following classes - land, buildings, plant and equipment and heritage and cultural. Investment properties are valued every year.

Revaluation adjustments are made on a class basis. Any revaluation increment is credited to equity under asset revaluation reserve, except to the extent that it reverses a previous revaluation decrement of the same asset class that was previously recognised in the surplus or deficit. Revaluation decrements for a class of assets are recognised directly through the statement of comprehensive income except to the extent that they reverse a previous revaluation increment for that class.

Any accumulated depreciation as at the revaluation date is restated proportionately with the change in the gross carrying amount of the asset so that the carrying amount of the asset after revaluation equals its revalued amount.

Fair value for each class of asset subject to the fair value model is determined as follows:

- Land, which will continue to be used to further the Group's objectives for research activity, is valued by independent valuers at fair value (highest and best use). Highest and best use is determined from the perspective of market participants. An entity's current use of a non-financial asset is presumed to be its highest and best use unless market or other factors suggest otherwise. Land underwent a full revaluation as at 30 June 2021 by Jones Lang LaSalle (JLL).
- Buildings and leasehold improvements, which will continue to be used to further the Group's objectives, are valued by independent valuers at fair value (highest and best use). Building valuations include plant, fit-outs, fixtures and fittings, which form an integral part of buildings. Buildings underwent a full revaluation as at 30 June 2021 by JLL.
- Plant and equipment which will continue to be used to further the Group's objectives, are valued by independent valuers at fair value (highest and best use). Plant and equipment assets were revalued as at 30 June 2019.

Accounting Policy (cont'd)

- Properties held for sale are valued at the lower of their carrying amount and fair value less cost to sell. An assessment is undertaken annually of any properties held for sale.
- Heritage and cultural assets are valued by independent valuers at their depreciated replacement cost. Heritage and cultural assets underwent a full revaluation as at 30 June 2021 by JLL.

In addition to independent valuations conducted, CSIRO makes an internal assessment at balance date considering any major events, market changes or indicators of impairment that may impact on fair value.

Depreciation and Amortisation

Depreciable property, plant and equipment assets are written-off to their estimated residual values over their estimated useful lives using, in all cases, the straight-line method of depreciation. Leasehold improvements are depreciated on a straight-line basis over the lesser of the estimated useful life of the improvements or the unexpired period of the lease. Land is not depreciated. The depreciation rates for ROU assets are based on the commencement date to the earlier of the end of the useful life of the ROU asset or the end of the lease term.

Depreciation/amortisation rates (useful lives), residual values and methods are reviewed at each reporting date and necessary adjustments are recognised in the current, or current and future reporting periods, as appropriate.

Depreciation rates applying to each class of depreciable asset are based on the following useful lives for 2020/21 and 2019/20:

Asset Class	Class of Depreciable Asset	
Land and Buildings	Buildings on freehold land	40 to 80 years
Land and Buildings	Leasehold Improvements	Lease term
Right of Use Asset	Buildings under lease	Lease term
Right of Use Asset	Equipment under lease	Lease term
Plant and Equipment	Passenger vehicles	7 years
Plant and Equipment	Agricultural and transport equipment	8 to 20 years
Plant and Equipment	Computer Equipment	2 to 5 years
Plant and Equipment	Scientific Equipment	5 to 20 years
Plant and Equipment	Furniture and office equipment	5 to 15 years
Plant and Equipment	Workshop equipment	20 to 25 years
Plant and Equipment	Research vessel	25 years
Plant and Equipment	Australia telescope	15 to 58 years
Heritage and Cultural	Heritage and Cultural	Indefinite

Impairment

All assets were assessed for impairment as at 30 June 2021. Where indicators of impairment exist, the asset's recoverable amount is estimated and an impairment adjustment made if the asset's recoverable amount is less than its carrying amount.

The recoverable amount of an asset is the higher of its fair value less costs to sell and its value in use. Value in use is the present value of the future cash flows expected to be derived from the asset. Where the future economic benefit of an asset is not primarily dependent on the asset's ability to generate future cash flows, and the asset would be replaced if the entity were deprived of the asset, its value in use is taken to be its depreciated replacement cost.

Derecognition

An item of property, plant and equipment is derecognised upon disposal or when no further future economic benefits are expected from its use or disposal.

Heritage and Cultural Assets

Heritage and cultural items include buildings of historical or cultural significance. CSIRO has classified them as heritage and cultural assets as they are primarily used for purposes that relate to their cultural significance and original purpose. Heritage and cultural assets are stored and managed in ways to preserve their heritage and cultural value over time. Where conservation and preservation activities, specified in an asset's Heritage Management Plan, demonstrate that an asset will be maintained for an indefinite period, these items are considered to have indefinite useful lives and therefore, not subject to depreciation. Copies of the Heritage Management Plans may be obtained by contacting enquiries@csiro.au.

Intangibles

Intangibles are internally developed and acquired software for internal use. These assets are carried at cost, less accumulated amortisation and impairment losses, except where the estimated cost of software is less than the $250,000 threshold and expensed in the year of acquisition. Software are amortised on a straight-line basis over their anticipated useful lives. The useful lives are 2 to 10 years (2019-20: 2 to 10 years). All software assets were assessed for indications of impairment as at 30 June 2021.

Accounting Policy (cont'd)

Properties Held for Sale

Properties which are expected to be recovered primarily through sale rather than through continuing use are classified as 'properties held for sale'. Immediately before classification, the properties are remeasured in accordance with the Group's accounting policies. Thereafter, at reporting date the properties are measured at the lower of their carrying amount and fair value less cost to sell.

Impairment losses on initial classification as held for sale and subsequent gains or losses on re-measurement are recognised in the Statement of Comprehensive Income.

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 2.2B: Investment properties				
Reconciliation of the opening and closing balances of investment properties				
As at 1 July	**49,373**	52,072	**49,373**	52,072
Net gain/(loss) from fair value adjustments	**(357)**	(2,699)	**(357)**	(2,699)
Total as at 30 June	**49,016**	49,373	**49,016**	49,373

Accounting Policy

Investment properties are measured initially at cost, including transaction costs. Subsequent to initial recognition, investment properties are stated at fair value. Gains or losses arising from changes in the fair values of investment properties are recognised in profit or loss in the year in which they arise.

Investment properties are derecognised either when they have been disposed of or when the investment property is permanently withdrawn from use and no future economic benefit is expected from its disposal. Any gain or losses on disposal of an investment property are recognised in profit or loss in the year of disposal.

Investment properties were valued as at 30 June 2021 by JLL and CSIRO are of the opinion that there are no significant material differences between the carrying amounts of investment properties and fair value. Rental income from investment properties is included in the lease income disclosed in Note 1.2C and was $2.9m for 2021 (2020:$3.8m). Operating costs that are recoverable amounted to $1.0m for 2021 (2020: $1.2m).

Note 2.2C: Other non-financial assets				
Prepayments	**12,416**	18,748	**12,371**	18,803
Total other non-financial assets	**12,416**	18,748	**12,371**	18,803

2.3. Payables

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 2.3A: Suppliers				
Suppliers payable	**49,957**	54,220	**47,374**	51,319
Contract liabilities	**168,057**	160,801	**166,615**	158,881
Total	**218,014**	215,021	**213,989**	210,200

Accounting Policy

Contract liabilities are associated with consideration that has been received from the customer but services are yet to be performed by the Group.

Note 2.3B: Other Payables				
Accrued salaries and wages	**15,354**	12,267	**15,318**	12,153
Other creditors and accrued expenses	**680**	142	**398**	956
GST payable to ATO	**-**	5,387	**-**	5,492
Total other payables	**16,034**	17,796	**15,716**	18,601

Accounting Policy

Accounting policy for contract revenue received in advance is contained in Note 1.2.

Note 2.3C: Deposits

Deposits represent monies held on behalf of third parties. If the amounts are not spent for their specified purpose they will be returned to the third party.

Other	**21,800**	22,508	**23,469**	25,588
Total deposits held are:	**21,800**	22,508	**23,469**	25,588

2.4. Interest Bearing Liabilities

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 2.4: Leases				
Lease liabilities				
Buildings	**78,779**	114,620	**78,056**	113,251
Plant and equipment	**2,237**	2,120	**2,237**	2,120
Total Leases	**81,016**	**116,740**	**80,293**	**115,371**
Maturity analysis - contractual undiscounted cash flows				
Within 1 year	**25,863**	43,366	**25,271**	42,748
Between 1 to 5 years	**51,141**	66,414	**50,994**	65,630
More than 5 years	**7,885**	13,924	**7,885**	13,923
Total Leases	**84,889**	123,704	**84,150**	122,301

The cash outflow for leases for the year ended 30 June 2021 was $43.8m for CSIRO and $44.4m for the Group. Both the Group and CSIRO have multiple leasing arrangements relating to land, buildings and equipment.

The above lease disclosures should be read in conjunction with the accompanying notes 1.1B, 1.1C, 1.2C, 2.2A.

Accounting Policy

For all new contracts entered into, CSIRO considers whether the contract is, or contains, a lease. A lease is defined as 'a contract, or part of a contract, that conveys the right to use an asset (the underlying asset) for a period of time in exchange for consideration'.

Once it has been determined that a contract is, or contains a lease, the lease liability is initially measured at the present value of the lease payments unpaid at the commencement date, discounted using the interest rate implicit in the lease, if that rate is readily determinable, or the incremental borrowing rate.

Subsequent to initial measurement, the liability will be reduced for payments made and increased for interest. It is remeasured to reflect any reassessment or modification to the lease. When the lease liability is remeasured, the corresponding adjustment is reflected in the right-of-use asset or profit and loss depending on the nature of the reassessment or modification.

2.5. Other Provisions

Note 2.5: Provision for Remediation				
Provision for Remediation	**62,776**	40,457	**62,776**	40,457
Total Provision for Remediation	**62,776**	40,457	**62,776**	**40,457**

CSIRO currently has provisions for remediation associated with:

- Restoring land and decontaminating land; and
- Restoring leased CSIRO sites to their original condition at the conclusion of the lease, represented in the agreements for the leasing of the premises.

Accounting Judgements and Estimates

The provision for restoring and decontaminating land is based on estimates provided by internal and external qualified experts. The provision is predominately based on externally provided costings, with additional amounts derived from comparable remediation works. The provision is based on the scope of work as it currently stands as at 30 June 2021. As remediation work progress, the scope and costs may be subject to change. The work is expected to take several years to reach completion.

The provision for the makegood/restoration costs at leased CSIRO sites are based on rates provided by an external valuer.

3. People and Relationships

This section describes a range of employment and post employment benefits provided to our people and our relationship with other key people.

3.1. Employee Provisions

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 3.1A: Employee Provisions				
Annual leave	**71,022**	67,101	**70,805**	66,917
Long service leave	**174,327**	182,621	**174,327**	182,621
Severance pay	**8,342**	8,036	**8,342**	8,036
Redundancies	**11,009**	5,155	**11,009**	5,155
Total employee provisions	**264,700**	262,913	**264,483**	262,729

Accounting Policy (including Accounting Judgements and Estimates)

Liabilities for short-term employee benefits (as defined in AASB 119 *Employee Benefits*) and termination benefits due within twelve months of the end of the reporting period are measured at their nominal amounts. The nominal amount is calculated with regard to the rate expected to be paid on settlement of the liability.

Other long-term employee benefit liabilities are measured at the present value of the estimated future cash outflows to be made in respect of services provided by employees up to the reporting date.

Leave

The liability for employee benefits includes provisions for annual leave and long service leave. No provision has been made for sick leave as all sick leave is non-vesting and the average sick leave taken in future years by employees is estimated to be less than the annual entitlement for sick leave.

The leave liabilities are calculated on the basis of employees' remuneration at the estimated salary rates that will apply at the time the leave is taken, including the employer superannuation contribution rates to the extent that the leave is likely to be taken during service rather than paid out on termination.

The liability at 30 June 2021 for long service leave and annual leave has been determined by the short hand method and reference to the work of the Australian Government Actuary (AGA). The estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

Separation and Redundancy

Provision is made for separation and redundancy benefit payments. A CSIRO plan of termination is binding when the following criteria are met:

- actions required to complete the plan indicate that it is unlikely that significant changes to the plan will be made;
- the plan identifies the number of employees whose employment is to be terminated; and
- the plan established the termination benefits that employees will receive.

Superannuation

Employees of CSIRO are members of the Commonwealth Superannuation Scheme (CSS), the Public Sector Superannuation Scheme (PSS), the PSS accumulation plan (PSSap) or industry schemes. The CSS and PSS are defined benefit schemes for the Australian Government. The PSSap is a defined contribution scheme.

The liability for defined benefits is recognised in the financial statements of the Australian Government and is settled by the Australian Government in due course. This liability is reported in the Department of Finance's administered schedules and notes.

CSIRO makes employer contributions to the employee superannuation schemes at rates determined by an actuary to be sufficient to meet the cost to the Government of the superannuation entitlements of the Group's employees. CSIRO accounts for the contributions as if they were contributions to defined contribution plans.

The liability for superannuation recognised as at 30 June 2021 represents outstanding contributions for the financial year.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

3.2 (a) Key Management Personnel Remuneration

Key management personnel are those persons having authority and responsibility for planning, directing and controlling the activities of CSIRO, directly or indirectly, including any director of CSIRO. Those key management personnel along with their remuneration are reported in table below.

		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits			
CSIRO Key Management Personnel	**Position**	**Base Salary $**	**Performance Payments $**	**Other Benefits and Allowances $**	**Super-annuation Contributions $**	**Long Service Leave $**	**Other Long Term Benefits $**	**Termination Benefits $**	**Total Remuneration $**
Marshall, Larry	Chief Executive	681,984	209,993	25,016	22,036	17,774	-	-	**956,803**
Zielke, Judi	Chief Operating Officer	404,687	27,300	-	68,695	10,089	-	-	**510,771**
Mayfield, Peter	Executive Director - Environment, Energy & Resources	471,366	27,750	17,381	68,256	10,535	-	-	**595,288**
Rose, Kirsten	Executive Director - Future Industries	420,056	27,205	15,849	22,573	5,231	-	-	**490,914**
Williams, David	Executive Director - Digital, National Facilities and Collections	462,852	25,200	17,381	21,904	10,871	-	-	**538,208**
Total remuneration for CSIRO Key Management Personnel		**2,440,945**	**317,448**	**75,627**	**203,464**	**54,500**	**-**	**-**	**3,091,984**
CSIRO Subsidiary Key Management Personnel									
Jimenez, Orlando	Fundacion CEO	272,254	-	869	-	-	-	-	**273,123**
Total remuneration for Fundacion		**272,254**	**-**	**869**	**-**	**-**	**-**	**-**	**273,123**
Total Consolidated Remuneration for Key Management Personnel		**2,713,199**	**317,448**	**76,496**	**203,464**	**54,500**	**-**	**-**	**3,365,107**

Performance payments represent remuneration amounts at risk within employment contracts. Actual performance payment amounts are decided by the board following the end of year. Performance and termination payments are included in the above table based on the relevant period in which the decision was made to make the payment.

3.2 (b) Senior Executive Staff Remuneration

Senior Executive Staff Remuneration		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits			
Remuneration Band	Number of Senior Executive Staff	Average Base Salary $	Average Performance Payments $	Average Other Benefits and Allowances $	Average Super-annuation Contributions $	Average Long Service Leave $	Average Other Long Term Benefits $	Average Termination Benefits $	Average Total Remuneration $
$0 - $220,000	**6**	62,386	5,934	4,606	10,759	12,331	-	-	**96,016**
$295,001 - $320,000	**2**	229,190	17,925	17,381	39,056	7,036	-	-	**310,588**
$320,001 - $345,000	**3**	260,314	13,162	16,482	32,503	5,545	-	-	**328,006**
$345,001 - $370,000	**4**	257,732	18,566	29,644	41,169	10,300	-	-	**357,411**
$395,001 - $420,000	**1**	312,711	18,339	17,381	44,523	6,956	-	-	**399,910**
$420,001 - $445,000	**3**	333,003	23,164	21,490	42,460	6,194	-	-	**426,311**
$470,001 - $495,000	**1**	425,696	-	16,182	22,551	5,754	-	-	**470,183**

During the reporting period ended 30 June 2021, CSIRO had twenty executives who meet the definition of senior executive staff. This note has been prepared on an accrual basis for substantive and long term acting senior management personnel during the period. Base Salary includes annual leave accrued in the period.

Performance payment amounts represent estimated amounts based on the contract amount allowable. Actual performance payments are decided by the Board following the end of financial year. Performance and termination payments are included in the above table based on the relevant period in which the decision was made to make the payment.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

3.2. (c) Remuneration of highly paid staff

Remuneration of other highly paid staff		Short Term Benefits			Post Employment	Other Long Term Benefits		Average Termination Benefits	Average Total Remuneration
		Average Base Salary	Average Performance Payments	Average Other Benefits and Allowances	Average Super-annuation Contributions	Average Long Service Leave	Average Other Long Term Benefits		
Remuneration Band	Number of Highly Paid Staff	$	$	$	$	$	$	$	$
$230,000 - $255,000	**75**	176,961	3,715	7,408	30,848	6,747	-	13,911	239,590
$255,001 - $280,000	**43**	173,515	5,962	10,789	29,457	9,111	-	37,487	266,321
$280,001 - $305,000	**13**	193,023	10,444	23,677	31,345	8,592	-	25,687	292,768
$305,001 - $330,000	**8**	229,262	17,197	15,208	34,511	9,549	-	14,163	319,890
$330,001 - $355,000	**8**	261,739	17,322	20,573	36,536	7,851	-	-	344,021
$355,001 - $380,000	**9**	244,706	5,906	3,862	30,524	20,945	-	61,567	367,510
$405,001 - $430,000	**1**	164,060	13,500	210,129	24,073	5,456	-	-	417,218
$430,001 - $455,000	**1**	343,487	54,000	-	47,916	8,778	-	-	454,181

Base salary includes annual leave accrued in the period.

Performance payment amounts represent estimated amounts based on the contract amount allowable. Actual performance payments are decided by the Board following the end of financial year. Performance and termination payments are included in the above table based on the relevant period in which the decision was made to make the payment.

3.3. Remuneration of Board Members

		Short Term Benefits		Post employment benefits	
Board member	**Term**	**Base Salary $**	**Other benefits and allowances $**	**Super Contributions $**	**Total 2020-21 Remuneration $**
Michele Allan	05.05.16 - 04.05.19; 05.05.19 - 04.05.24	70,455	8,165	7,477	**86,097**
Drew Clarke	24.08.17 - 23.08.22	70,455	8,165	7,477	**86,097**
Edwina Cornish	26.11.15 - 25.11.20; 26.11.20 - 25.11.23	70,455	8,165	7,477	**86,097**
Kathryn Fagg	02.08.18 - 01.08.23; 17.09.20 - 18.09.25	70,455	16,293	8,259	**95,007**
David Knox	05.05.16 - 04.05.19; 05.05.19 - 04.05.24	70,455	12,008	7,842	**90,305**
Tanya Monro	25.02.16 - 24.02.21; 25.02.21 - 24.02.24	-	-	-	**-**
Peter Riddles	24.04.14 - 23.04.17; 24.04.17 - 23.04.22	70,455	20,173	8,618	**99,246**
David Thodey (Chair)	15.10.15 - 14.10.20; 15.10.20 - 14.10.21	146,309	-	13,130	**159,439**
Michelle Simmons	17.09.20 - 16.09.25	23,755	-	2,526	**26,281**
Total remuneration for CSIRO Board Members		**592,794**	**72,969**	**62,806**	**728,569**
Board Members (Chile Fundacion)					
Claudia Bobadilla	15.03.17 - 15.03.22	32,306	-	-	**32,306**
Maria Del Rosario Navarro	13.09.19 - 13.09.24	32,328	-	-	**32,328**
Total remuneration for Board Members (Chile Fundacion)		**64,634**	**-**	**-**	**64,634**
Total Consolidated Remuneration for CSIRO Group		**657,428**	**72,969**	**62,806**	**793,203**

The remuneration of the Chief Executive, who is also a CSIRO Board Member is reported under Note 3.2 Key Management Personnel Remuneration. Kathryn Fagg was employed deputy chair of the board from 17.09.20. Michelle Simmons term as board member began on 17.09.20, but commencement date was 01.03.21.

Tanya Monro was appointed as the Chief Defence Scientist and continues to be a CSIRO board member but is no longer entitled to remuneration based on the *Remuneration Tribunal Act 1973.*

3.4. Related Party Disclosures

(a) Controlled Entities

The Science and Industry Endowment Fund ('SIEF') was established under the *Science and Industry Endowment Act 1926*. The principal activity of the SIEF Trust is to provide assistance to persons engaged in scientific research and in training of students in scientific research. The SIEF Trustee is the CSIRO Chief Executive and SIEF is a wholly controlled entity. The SIEF's separate financial statements are reported in the CSIRO Annual Report.

Chile Research Fundación ('Fundación') was established in October 2013. The Fundación is a controlled entity governed by a Board in accordance with the Constitution of the Fundación. The Fundación is working with industry and leading Chilean Universities to develop cutting-edge technologies to reduce the environmental impact of mining and increase productivity.

National ICT Australia ('NICTA') is Australia's ICT Research Centre of Excellence and undertakes internationally recognised research in partnership with industry, government and researchers to create national benefit and wealth for Australia. NICTA is the parent entity of NICTA IPR Pty Ltd and a small number of minor proprietary limited companies that exist to hold intellectual property and commercialise research. CSIRO obtained full control of NICTA on 28 August 2015, when the members of the NICTA Board resolved to adopt a revised company constitution which provided CSIRO with effective control over NICTA.

CSIRO has established an Innovation Fund with Commonwealth funding support to invest in the development of early stage technology opportunities from the public research sector, to increase their translation into commercial opportunities to be taken up by Australian industry. The Fund has been established through a structure of entities whose purpose is to manage and operate the Fund.

The entities that comprise the Innovation Fund are:

- CSIRO Innovation Fund 1, LP is an incorporated limited partnership formed under the *Partnership Act 1892 (NSW)*. It is registered by Innovation and Science Australia as an Early Stage Venture Capital Limited Partnership (ESVCLP). It was established in January 2017.
- CSIRO Management Partnership, LP is an incorporated limited partnership formed under the *Partnership Act 1892 (NSW)*. It was established in January 2017 as a Venture Capital Management Partnership and acts as the general partner of the CSIRO Innovation Fund 1, LP.
- CSIRO General Partner 2 Pty Ltd was established in December 2016 and is a small proprietary company limited by shares, which are solely held by CSIRO. This company acts as the general partner of CSIRO Management Partnership, LP.
- CSIRO Fund of Funds, LP is an incorporated limited partnership formed under the *Partnership Act 1892 (NSW)* and is registered by Innovation and Science Australia as an Australian Venture Capital Fund of Funds. It was established in May 2016 and its limited partner is CSIRO. The Fund is also a limited partner of CSIRO Innovation Fund 1, LP.
- CSIRO Innovation Holding Trust is a trust established in July 2018. Its sole Member is CSIRO and it is also a Member of the CSIRO Innovation Follow-On Fund 1.
- CSIRO General Partner Pty Ltd was established in May 2016 and is a small proprietary company limited by shares, which are solely held by CSIRO. It acts as the general partner of CSIRO Fund of Funds LP and is also the trustee of CSIRO Innovation Holding Trust.
- CSIRO Financial Services Pty Ltd was established in December 2015 and is a small proprietary company limited by shares, which are solely held by CSIRO. The company has been issued an Australian Financial Services License by ASIC and acts as Manager of CSIRO Innovation Fund 1, LP.
- CSIRO Follow-On Services Pty Ltd was established in April 2018 and is a small proprietary company limited by shares, which are solely held by CSIRO. It serves as trustee of the CSIRO Innovation Follow-On Fund 1.
- CSIRO Innovation Follow-On Fund 1 was established October 2018 and is structured as a managed investment trust, formed to provide follow-on investment to companies supported by CSIRO Innovation Fund 1, LP.
- CSIRO Innovation Services Pty Ltd was established in October 2016 and is a small proprietary company limited by shares, which are solely held by CSIRO. It acts as trustee of a discretionary trust established to distribute

some returns from CSIRO Innovation Fund 1, LP, and as trustee of a unit trust established to distribute some returns form CSIRO Innovation Follow-On Fund 1.

- CSIRO Innovation Fund Discretionary Trust was established in January 2017 to hold and distribute some of the returns from CSIRO Innovation Fund 1, LP according to an agreed distribution policy administered by CSIRO Innovation Services Pty Ltd.
- CSIRO Follow-On Sponsor Trust was established in June 2019 for the purpose of distributing carried interest from the CSIRO Innovation Follow-On Fund 1.
- CSIRO Innovation Fund 2, LP is an incorporated limited partnership formed under the *Partnership Act 1892* (NSW). It is registered by Innovation and Science Australia as an Early Stage Venture Capital Limited Partnership (ESVCLP). It was established in March 2020.
- CSIRO Management Partnership 2, LP is an incorporated limited partnership formed under the *Partnership Act 1892 (NSW)*. It was established in March 2020 as a Venture Capital Management Partnership and acts as the general partner of the CSIRO Innovation Fund 2, LP.
- CSIROGP Fund 2 Pty Ltd was established in March 2020 and is a small proprietary company limited by shares, which are solely held by CSIRO. This company acts as the general partner of CSIRO Management Partnership Pty 2, LP.
- CSIRO Follow-On Services 2 Pty Ltd was established in March 2020 and is a small proprietary company limited by shares, which are solely held by CSIRO. It will serve as the trustee of CSIRO Innovation Follow-On Fund 2, which is yet to be established and will be set up as a managed investment trust.
- CSIRO Custodial Services Pty Ltd was established in April 2020 for the purpose of providing custodial services under an Australian Financial Services Licence to the Innovation Fund entities.

All of the above Innovation Fund related companies are under the sole control of the CSIRO as at 30 June 2021. The above entities (with the exception of CSIRO Financial Services Pty Ltd; CSIRO Innovation Services Pty Ltd; and CSIRO Custodial Services Pty Ltd) sit outside the General Government Sector.

CSIRO USA LLC and CSIRO Innovations LLC were established in February 2017 to support the establishment of a CSIRO presence in the United States. Both entities are incorporated within Delaware and are wholly controlled by the CSIRO.

(b) Related party relationships

CSIRO is an Australian Government controlled entity. Related parties to CSIRO are the Board, Key Management Personnel including the Portfolio Minister and Executive, and other Australian Government entities.

Transactions with related parties:

Given the breadth of Government activities, related parties may transact with the government sector in the same capacity as ordinary citizens. Such transactions include the payment or refund of taxes, receipt of a Medicare rebate or higher education loans. These transactions have not been separately disclosed in this note.

Significant transactions with related parties can include the payments of grants or loans, purchases of goods and services, asset purchases, sales transfers or leases, debts forgiven and guarantees. Giving consideration to relationships with related entities, and transactions entered into during the reporting period by CSIRO, it has been determined that there are no related party transactions to be separately disclosed.

4. Managing Uncertainties

This section analyses how CSIRO manages financial risk within its operating environment.

4.1. Contingent Assets and Liabilities

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Quantifiable Contingencies				
Contingent assets				
Insurance claims	**26,044**	15,958	**26,044**	15,958
Bank guarantees received from suppliers	**5,405**	5,237	**5,405**	5,237
Total contingent assets	**31,449**	21,195	**31,449**	21,195
Contingent liabilities				
Estimated legal claims	**-**	6,000	**-**	6,000
Total contingent liabilities	**-**	6,000	**-**	6,000
Total net contingent asset/(liability)	**31,449**	15,195	**31,449**	15,195

At 30 June 2021, CSIRO has an outstanding insurance claim for business interruption and costs incurred from a natural disaster (hailstorm) that occurred at CSIRO Black Mountain on 20 January 2020. This claim has not been fully settled which includes $25.0m of the total $26.0m above.

All legal claims were settled within the current financial year.

Depending on the materiality of risks involved with certain commercial transactions, CSIRO has requested bank guarantees where necessary to mitigate risks, notably where substantial advance payments were made.

Unquantifiable contingencies

As disclosed in the Overview Note, a financial provision for the estimated costs in restoring and decontaminating land where a legal or constructive obligation has arisen has been recognised on the Statement of Financial Position. For cases where there is no legal or constructive obligation, the potential costs have not been assessed and are unquantifiable contingencies. CSIRO has no other identified unquantifiable contingencies to report.

Accounting Policy

Contingent liabilities and contingent assets are not recognised in the Statement of Financial Position. They may arise from uncertainty as to the existence of a liability or asset, or represent a liability or asset in respect of which the amount cannot be reliably measured. Contingent assets are disclosed when settlement is probable but not virtually certain and contingent liabilities are disclosed when settlement is greater than remote.

4.2. Financial Instruments

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 4.2A: Categories of financial instruments				
Financial Assets				
Financial assets at fair value through profit or loss				
Investments	**477,903**	304,490	**214,650**	177,467
Total financial assets at fair value through profit and loss	**477,903**	304,490	**214,650**	177,467
Financial assets at amortised cost				
Cash at bank	**298,586**	371,496	**211,872**	270,619
Term deposits	**239,050**	32,000	**192,000**	32,000
Receivable for goods and services	**80,712**	88,636	**77,123**	87,497
Other receivables	**3,924**	1,399	**3,444**	3,120
Total financial assets at amortised cost	**622,272**	493,531	**484,439**	393,236
Total financial assets	**1,100,175**	798,021	**699,089**	570,703
Financial Liabilities				
Financial liabilities measured at amortised cost				
Trade creditors	**218,014**	215,021	**213,989**	210,200
Other creditors	**16,034**	17,796	**15,716**	18,601
Lease liabilities	**81,016**	116,740	**80,293**	115,371
Deposits	**21,800**	22,508	**23,469**	25,588
Total financial liabilities at amortised cost	**336,864**	372,065	**333,467**	369,760
Total financial liabilities	**336,864**	372,065	**333,467**	369,760

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 4.2B: Net income and expense from financial assets				
Financial assets at amortised cost				
Interest revenue	**3,425**	5,772	**2,755**	4,251
Impairment expense	**(906)**	(1,304)	**(906)**	(895)
Net gain from financial assets at amortised cost	**2,519**	4,468	**1,849**	3,356
Investments assets at fair value through profit or loss				
Fair value changes	**119,961**	101,503	**19,905**	43,915
Net gain/(loss) from investment assets at fair value through profit or loss	**119,961**	101,503	**19,905**	43,915
Net gain/(loss) on financial assets	**122,480**	105,971	**21,754**	47,271
Note 4.2C: Net income and expense from financial liabilities				
Financial liabilities measured at amortised cost				
Interest expense	**2,308**	2,707	**2,273**	2,666
Net loss from financial liabilities	**2,308**	2,707	**2,273**	2,666

Accounting Policy

Financial Assets

The Group classifies its financial assets under AASB 9 *Financial Instruments* in the following categories:

a) financial assets at fair value through profit or loss;

b) financial assets at fair value through other comprehensive income; and

c) financial assets measured at amortised cost.

The classification depends on both the entity's business model for managing the financial assets and contractual cash flow characteristics at the time of initial recognition. Financial assets are recognised when the Group becomes a party to the contract and, as a consequence, has a legal right to receive or a legal obligation to pay cash and derecognised when the contractual rights to the cash flows from the financial asset expire or are transferred upon trade date.

Financial Assets at Amortised Cost

Financial assets included in this category need to meet two criteria:

1. the financial asset is held in order to collect the contractual cash flows; and

2. the cash flows are solely payments of principal and interest (SPPI) on the principal outstanding amount.

Amortised cost is determined using the effective interest method.

Effective Interest Method

Income is recognised on an effective interest rate basis for financial assets that are recognised at amortised cost.

Financial Assets at Fair Value Through Other Comprehensive Income (FVOCI)

Financial assets measured at fair value through other comprehensive income are held with the objective of both collecting contractual cash flows and selling the financial assets and the cash flows meet the SPPI test. Any gains or losses as a result of fair value measurement or the recognition of an impairment loss allowance is recognised in other comprehensive income.

Financial Assets at Fair Value Through Profit or Loss (FVTPL)

Financial assets are classified as financial assets at fair value through profit or loss where the financial assets either don't meet the criteria of financial assets held at amortised cost or at FVOCI (i.e. mandatorily held at FVTPL) or may be designated. Financial assets at FVTPL are stated at fair value, with any resultant gain or loss recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest earned on the financial asset. CSIRO values it’s equity investment portfolio in listed companies, unlisted companies and in Uniseed Trust as FVTPL. CSIRO Innovation Fund values it’s equity investment portfolio in unlisted companies as FVTPL.

Accounting Policy (cont'd)

Impairment of Financial Assets

Financial assets at amoritised cost are assessed for impairment at the end of each reporting period based on Expected Credit Losses, using the general approach which measures the loss allowance based on an amount equal to lifetime expected credit losses where risk has significantly increased, or an amount equal to 12-month expected credit losses if risk has not increased.

The simplified approach for trade, contract and lease receivables is used. This approach always measures the loss allowance as the amount equal to the lifetime expected credit losses. A write-off constitutes a de-recognition event where the write off directly reduces the gross carrying amount of the financial asset.

Financial liabilities

Financial liabilities are classified as either financial liabilities 'at fair value through profit or loss' or financial liabilities at amoritised cost. Financial liabilities are recognised and derecognised upon 'trade date'.

Financial Liabilities at Fair Value Through Profit or Loss

Financial liabilities at fair value through profit or loss are initially measured at fair value. Subsequent fair value adjustments are recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest paid on the financial liability.

Financial Liabilities at Amortised Cost

Financial liabilities at amortised cost, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

Supplier and other payables are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

4.3. Fair Value Measurement

Note 4.3A: Fair value measurement

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Financial assets				
Other investments	**477,903**	304,490	**214,650**	177,467
Total financial assets	**477,903**	304,490	**214,650**	177,467
Non-financial assets				
Land	**411,686**	386,600	**411,686**	386,600
Buildings	**1,206,722**	1,221,649	**1,206,026**	1,220,331
Plant and equipment	**540,596**	559,183	**540,452**	559,009
Investment properties	**49,016**	49,373	**49,016**	49,373
Properties held for sale	**5,200**	5,200	**5,200**	5,200
Heritage and cultural	**9,952**	4,463	**9,952**	4,463
Total non-financial assets	**2,223,172**	2,226,468	**2,222,332**	2,224,976
Financial liabilities				
Lease liabilities	**81,016**	116,740	**80,293**	115,371
Deposits	**21,800**	22,508	**23,469**	25,588
Total financial liabilities	**102,816**	139,248	**103,762**	140,959

Accounting Judgements and Estimates

In the process of applying the accounting policies listed in this note, CSIRO has made the following judgements that have the most significant impact on the amounts recorded in the financial statements:

- Properties classified as 'properties held for sale' are measured at the lower of the carrying amount and fair value less costs to sell, 'investment properties' has been taken to be the market value (level 2 inputs), of similar properties as determined by an independent valuer;

Accounting Judgements and Estimates (cont'd)

- The fair value of land which will continue to be used to further the Group's objectives for research activities, and buildings held for specialised purposes and where there is no readily available market price has been taken to be Fair Value- Highest and Best Use (level 3 inputs), as determined by an independent valuer;
- The fair value of plant and equipment has been taken to be Fair Value – Highest and Best Use (level 2 and 3 inputs) as they mainly comprise of specialised research equipment. Fair value is determined by an independent valuer; and
- The fair value of listed companies is assessed at market value (level 1 inputs); whereas unlisted companies and commercial vehicles are assessed at fair value using the best information available (level 3 inputs). For investments in unlisted companies where there is no readily available market pricing, the fair value has been determined by applying valuation techniques in line with the generally accepted valuation guidelines 'International Private Equity and Venture Capital Valuation Guidelines (IPEV).' Where recent transactions for the unlisted companies' equity have taken place, these equity transaction prices are used to value CSIRO's investment. For unlisted companies that have not had any recent equity transactions, other IPEV valuation techniques are used such as discounted cash flows and share of net assets. Investments in special purpose entities are either valued at cost of share of net realisable assets since a reliable estimate of fair value cannot be established. These entities have been set up primarily to gain access to research facilities/networks, or to provide services to owners. Hence, there is not 'active market' for these equity investments.

No accounting assumptions and estimates have been identified that have a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next reporting period.

5. Other information

5.1. Current/non-current distinction for assets and liabilities

	Consolidated		CSIRO	
	2021	2020	**2021**	2020
	$'000	$'000	**$'000**	$'000
Note 5.1A: Current/non-current distinction for assets and liabilities				
Assets expected to be recovered in:				
No more than 12 months				
Cash and cash equivalents	**537,636**	403,496	**403,872**	302,619
Trade and other receivables	**88,974**	88,945	**85,206**	89,936
Other investments	**-**	23,948	**-**	153,464
Total no more than 12 months	**626,610**	516,389	**489,078**	546,019
More than 12 months				
Other non-financial assets	**12,416**	18,748	**12,371**	18,803
Land and buildings	**1,618,408**	1,608,249	**1,617,712**	1,606,931
Heritage and cultural	**9,952**	4,463	**9,952**	4,463
Plant and equipment	**540,596**	559,183	**540,452**	559,009
Investment properties	**49,016**	49,373	**49,016**	49,373
Intangibles	**19,716**	13,650	**19,716**	13,650
Inventories	**1,315**	1,420	**1,315**	1,420
Other investments	**477,903**	280,542	**214,650**	24,003
Total more than 12 months	**2,729,322**	2,535,628	**2,465,184**	2,277,652
Properties held for sale	**5,200**	5,200	**5,200**	5,200
Total assets	**3,361,132**	3,057,217	**2,959,462**	2,828,871
Liabilities expected to be settled in:				
No more than 12 months				
Suppliers	**218,014**	215,021	**213,989**	210,200
Other payables	**16,034**	17,796	**15,716**	18,601
Leases	**24,642**	41,480	**24,065**	40,950
Employee provisions	**75,988**	1,186	**75,847**	1,914
Provision for remediation	**17,690**	-	**17,715**	-
Deposits	**5,389**	708	**6,906**	2,119
Total no more than 12 months	**357,757**	276,191	**354,238**	273,784
More than 12 months				
Leases	**56,374**	75,260	**56,228**	74,421
Employee provisions	**188,712**	261,727	**188,636**	260,815
Provision for remediation	**45,086**	40,457	**45,061**	40,457
Deposits	**16,411**	21,800	**16,563**	23,469
Total more than 12 months	**306,583**	399,244	**306,488**	399,162
Total liabilities	**664,340**	675,435	**660,726**	672,946

5.2. Monies Held in Trust

	2021	2020
	$'000	$'000
Monies held in trust represented by cash, deposits and investments for the benefit of the Group which are not included in the Statement of Financial Position are:		
The Sir Ian McLennan Achievement for Industry Award - established to award outstanding contributions by the Group's scientists and engineers to national development.	**437**	366
The Elwood and Hannah Zimmerman Trust Fund - established to fund weevil research and the curation of the Australian National Insect Collection (ANIC) weevil collection.	**5,021**	4,933
The Schlinger Trust - established to research the taxonomy, biosystematics, general biology and biogeography of Australasian Diptera conducted by the Australian National Insect Collection.	**2,377**	2,273
Total monies held in trust as at 30 June	**7,835**	7,572

Summary of movements:	**McLennan $'000**	**Zimmerman $'000**	**Schlinger $'000**	**Total $'000**
Balance as at 1 July 2020	**366**	**4,933**	**2,273**	**7,572**
Adjustments	**-**	**-**	**-**	**-**
Interest and distribution adjustments	**71**	**514**	**232**	**817**
Expenditure in the period	**-**	**(426)**	**(128)**	**(554)**
Balance as at 30 June 2021	**437**	**5,021**	**2,377**	**7,835**

5.3. Collections

CSIRO is the custodian of several collections used for scientific research. These collections have been established over time and document an extensive range of Australian flora and fauna species. The collections are irreplaceable, bear scientific and historical value and are not reliably measurable in monetary terms. Therefore, CSIRO has not recognised them as an asset in its financial statements.

The main collections held by CSIRO are:

- Australian National Herbarium (ANH) – With a focus on the Australian flora and that of neighbouring regions such as New Guinea and the Pacific, the ANH has over 1 million herbarium specimens, with additional holdings at the Australian Tropical Herbarium (ATH) in Cairns, Queensland. The ANH collections include the Dadswell Memorial Wood Collection and comprehensive holdings of a number of groups, including cryptogams, eucalypts and orchids.

- Australian National Insect Collection (ANIC) – Specialising in Australian terrestrial invertebrates, ANIC houses over 12 million specimens and is the world's largest collection of Australian insects, as well as groups such as mites, spiders, earthworms, nematodes and centipedes. ANIC is an important research collection used by CSIRO researchers, university staff, and students, and scientists from Australian and international research organisations.

- Australian National Wildlife Collection (ANWC) – Specialising in terrestrial vertebrates, ANWC contains specimens of most species of Australian mammals, birds, reptiles, and amphibians. It is particularly rich in specimens of birds from New Guinea. ANWC is a valuable asset for biologists engaged in biodiversity research. Its research library holds 60,000 recordings of wildlife sounds, more than a thousand tissue samples, and egg collections from more than 300 bird species.

- Australian National Fish Collection (ANFC) – Specialising in marine fishes, the ANFC contains almost 150,000 specimens representing more than 3,000 species from the Indo-Pacific region. It is an invaluable resource for biodiversity and biogeographic research on Australian and Indo-Pacific fishes. Its major strengths are sharks, rays, and deep-water fishes. It also contains a large collection of images and radiographs of Australian fishes.

- Australian Tree Seed Centre (ATSC) – The ATSC is managed as a collection and research centre for Australian native tree species. For over 50 years the centre has been collecting, researching and supplying quality, fully documented tree seed to both domestic and overseas customers. Collections of seed are sourced from wild populations and genetically improved seed from our domestication and improvement programs.

- Australian National Algae Culture Collection (ANACC) – The ANACC consists of more than 300 microalgae species and is a resource for research on algal diversity, distribution, richness, and taxonomic relationships, including those of economic importance and environmental concern. Aligned with the collection is the National Algae Supply Service, which provides microalgae strains as starter cultures to industry, research organisations and educational institutions in over 70 countries.

5.4. Restructuring

5.4A Departmental Restructuring

The Data Standards Body was relinquished from CSIRO to the Department of Treasury in the 2020-21 budget year due to a decision made by Cabinet. The net liabilities relinquished to the Department of Treasury was $0.06m. In respect of functions assumed, the net book value of assets and liabilities were transferred to the Department of Treasury for no consideration.

	Data Standards Body CSIRO $'000
FUNCTIONS RELINQUISHED	
Liabilities relinquished	
Employee provisions	55
Total liabilities relinquished	**55**
Net liabilities relinquished	**55**

6. Budgetary Reports and Explanations of Major Variances

The following provides a comparison of the original budget as presented in the 2020-21 Portfolio Budget Statements to the actual outcome reported for 2020-21. The intention of this variance analysis is to provide the reader with information relevant to assessing the performance of CSIRO, including the accountability for the resources entrusted to it.

Statement of Comprehensive Income
for the period ended 30 June 2021

	Actual	Consolidated Original Budget	Variance
	2021	**2021**	2021
	$'000	**$'000**	$'000
NET COST OF SERVICES			
Expenses			
Employee benefits	**748,839**	**830,414**	81,575
Suppliers	**424,372**	**464,096**	39,724
Depreciation and amortisation	**182,713**	**192,148**	9,435
Finance costs	**2,308**	**3,581**	1,273
Write-downs and impairment loss on financial instruments	**906**	**-**	(906)
Write-downs and impairment of other assets	**7,340**	**-**	(7,340)
Loss on revaluation of investment properties	**356**	**-**	(356)
Losses from asset sales	**3,402**	**-**	(3,402)
Foreign exchange losses	**809**	**-**	(809)
Total expenses	**1,371,045**	**1,490,239**	119,194
Own-Source Income			
Own-source revenue			
Revenue from contracts with customers	**431,111**	**352,830**	78,281
Royalties and licence fees	**-**	**37,325**	(37,325)
Bank and term deposits interest	**3,425**	**4,898**	(1,473)
Rental income	**7,538**	**6,200**	1,338
Other revenues	**15,426**	**42,897**	(27,471)
Total own-source revenue	**457,500**	**444,150**	13,350
Gains			
Gains from sale of equity investments and intellectual property	**2,600**	**-**	2,600
Gains from asset sales	**-**	**-**	-
Gains on valuation of equity investments	**119,961**	**-**	119,961
Other gains	**16,255**	**-**	16,255
Foreign exchange gains	**-**	**-**	-
Total gains	**138,816**	**-**	**138,816**
Total own-source income	**596,316**	**444,150**	152,166
Net cost of services	**(774,729)**	**(1,046,089)**	271,360
Revenue from Government	**960,537**	**960,670**	(133)
Surplus/(Deficit)	**185,808**	**(85,419)**	271,227
OTHER COMPREHENSIVE INCOME			
Items not subject to subsequent reclassification to net cost of services			
Changes in asset revaluation reserves	**49,496**	**-**	49,496
Items subject to subsequent reclassification to net cost of services			
Changes in other reserves	**(56)**	**-**	(56)
Total other comprehensive income	**49,440**	**-**	49,440
Total comprehensive income/(loss)	**235,248**	**(85,419)**	320,667

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Statement of Financial Position
as at 30 June 2021

	Actual	Consolidated Original Budget	Variance
	2021	2021	2021
	$'000	$'000	$'000
ASSETS			
Financial Assets			
Cash and cash equivalents	**537,636**	**286,387**	251,249
Trade and other receivables	**88,974**	**87,698**	1,276
Other investments	**477,903**	**200,854**	277,049
Total financial assets	**1,104,513**	**574,939**	529,574
Non-Financial Assets			
Land and buildings	**1,618,408**	**1,612,501**	5,907
Heritage and cultural	**9,952**	**4,463**	5,489
Plant and equipment	**540,596**	**540,430**	166
Intangibles	**19,716**	**14,450**	5,266
Investment properties	**49,016**	**49,373**	(357)
Inventories	**1,315**	**1,420**	(105)
Other non-financial assets	**12,416**	**18,748**	(6,332)
Total non-financial assets	**2,251,419**	**2,241,385**	10,034
Properties held for sale	**5,200**	**-**	5,200
Total assets	**3,361,132**	**2,816,324**	544,808
LIABILITIES			
Payables			
Suppliers	**218,014**	**211,416**	(6,598)
Other payables	**16,034**	**17,842**	1,808
Deposits	**21,800**	**22,508**	708
Total payables	**255,848**	**251,766**	(4,082)
Interest Bearing Liabilities			
Leases	**81,016**	**84,431**	3,415
Total Interest bearing liabilities	**81,016**	**84,431**	3,415
Provisions			
Employee provisions	**264,700**	**266,905**	2,205
Provision for remediation	**62,776**	**31,288**	(31,488)
Total provisions	**327,476**	**298,193**	(29,283)
Total liabilities	**664,340**	**634,390**	(29,950)
Net assets	**2,696,792**	**2,181,934**	514,858
EQUITY			
Contributed equity	**327,384**	**326,134**	1,250
Asset revaluation reserves	**1,572,725**	**1,523,229**	49,496
Other reserves	**(259)**	**(240)**	(19)
Retained surplus	**582,925**	**332,811**	250,114
Non-controlling interest	**214,017**	**-**	214,017
Total equity	**2,696,792**	**2,181,934**	514,858

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Statement of Changes in Equity

for the period ended 30 June 2021

	Retained earnings			Asset revaluation reserve			Other reserves			Contributed equity/capital			Non-controlling interest			Total equity		
	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance
	2021	**2021**	2021	**2021**	**2021**	2021	**2021**	**2021**	2021	**2021**	**2021**	2021	**2021**	**2021**	2021	**2021**	**2021**	2021
	$'000	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000
Opening balance	**455,993**	418,230	37,763	**1,523,229**	1,523,229	-	**(203)**	(240)	37	**310,954**	310,954	-	**91,809**	-	91,809	**2,381,782**	2,252,173	129,609
Adjustment on initial application of AASB15/AASB 1058	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Adjustment on initial application of AASB 16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prior period error		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Adjusted opening balance	**455,993**	418,230	37,763	**1,523,229**	1,523,229	-	**(203)**	(240)	37	**310,954**	310,954	-	**91,809**	-	91,809	**2,381,782**	2,252,173	129,609
Comprehensive income																		
Other comprehensive income	-	-	-	**49,496**	-	49,496	**(56)**	-	(56)	-	-	-	-	-	-	**49,440**	-	49,440
Surplus/(deficit) for the period	**126,932**	(85,419)	212,351	-	-	-	-	-	-	-	-	-	**58,876**	-	58,876	**185,808**	(85,419)	271,227
Total comprehensive income	**126,932**	(85,419)	212,351	**49,496**	-	49,496	**(56)**	-	(56)	-	-	-	**58,876**		58,876	**235,248**	(85,419)	320,667
Other Movements	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Contributions by owners																		
Equity injection	-	-	-	-	-	-	-	-	-	**16,430**	15,180	1,250	**63,332**	-	63,332	**79,762**	15,180	64,582
Contributions by owners – other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Closing balance	**582,925**	332,811	250,114	**1,572,725**	1,523,229	49,496	**(259)**	(240)	(19)	**327,384**	326,134	1,250	**214,017**	-	214,017	**2,696,792**	2,181,934	514,858

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

Cash Flow Statement

for the period ended 30 June 2021

	Consolidated		
	Actual	Original Budget	Variance
	2021	2021	2021
	$'000	$'000	$'000
OPERATING ACTIVITIES			
Cash received			
Receipts from Government	**960,537**	**960,670**	(133)
Sale of goods and rendering of services	**506,929**	**483,697**	23,232
Interest	**3,181**	**5,227**	(2,046)
Net GST received	**13,807**	**-**	13,807
Total cash received	**1,484,454**	**1,449,594**	34,860
Cash used			
Employees	**743,647**	**826,422**	82,775
Suppliers	**450,083**	**502,779**	52,696
Interest payments on lease liabilities	**2,178**	**3,581**	1,403
Finance costs	**130**	**-**	(130)
Deposits	**708**	**-**	(708)
Net GST paid	**-**	**4,706**	4,706
Other	**-**	**9,169**	9,169
Total cash used	**1,196,746**	**1,346,657**	149,911
Net cash from operating activities	**287,708**	**102,937**	184,771
INVESTING ACTIVITIES			
Cash received			
Proceeds from sales of property, plant and equipment	**-**	**5,204**	(5,204)
Proceeds from sales of equity investments and intellectual property	**2,675**	**-**	2,675
Total cash received	**2,675**	**5,204**	(2,529)
Cash used			
Purchase of property, plant and equipment	**147,790**	**173,575**	25,785
Equity investments	**48,141**	**10,000**	(38,141)
Other selling costs	**29**	**-**	(29)
Losses from sales of property, plant and equipment	**4,321**	**-**	(4,321)
Total cash used	**200,281**	**183,575**	(16,706)
Net cash used in investing activities	**(197,606)**	**(178,371)**	(19,235)
FINANCING ACTIVITIES			
Cash received			
Contributed equity	**79,762**	**15,180**	64,582
Total cash received	**79,762**	**15,180**	64,582
Cash used			
Principal payments of lease liabilities	**35,724**	**37,185**	1,461
Total cash used	**35,724**	**37,185**	**1,461**
Net cash from financing activities	**44,038**	**(22,005)**	66,043
Net increase in cash held	**134,140**	**(97,439)**	231,579
Cash and cash equivalents at the beginning of the reporting period	**403,496**	**383,826**	19,670
Cash and cash equivalents at the end of the reporting period	**537,636**	**286,387**	251,249

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

Explanation of Major Variances

Australian Accounting Standard AASB *1055 Budgetary Reporting* requires variance explanations of major variances between the original budget, as presented in the 2020-21 Portfolio Budget Statements, and the actual outcome as reported in these financial statements. CSIRO considers that major variances are those greater than 10% of the original estimate and that are relevant to an assessment of the discharge of accountability and to an analysis of the performance of the entity. Variances below this threshold are not included unless considered significant by their nature.

Variances attributable to factors which would not reasonably have been identifiable at the time of the budget preparation, such as the revaluation of plant and equipment and investment properties, sale of equity investments, and impairment of assets, have not been included as part of the explanation.

The Budget is not audited.

Statement of Comprehensive Income

Employee benefits is lower than budget as total staff numbers were below expected levels due to recruitment delays and the inability to procure resources internationally. This also resulted in the associated *Supplier expenses* being below budget.

Own source revenue is higher than budget due to the forecasted impact of the Coronavirus ("COVID-19") on CSIRO and customers being less severe than was originally estimated.

Royalties and licence fees are disclosed separately in the PBS and included in *Revenue from contracts with customers* as per AASB 15 *Revenue from Contracts with Customers* in the financial statements.

Net gains are higher than budget due to an initial insurance payout for the damage caused by a hailstorm at the Black Mountain site in January 2020, and an unbudgeted increase in the value of both CSIRO's and the CSIRO Innovation Fund's equity portfolio.

Statement of Financial Position

Cash and cash equivalents are higher than budget due to the difference in basis of preparation between the PBS and the financial statements relating to the Innovation Fund investment. The Portfolio Budget Statements are prepared on the basis of only including General Government Sector (GGS) entities, whereas the Financial Statements for CSIRO include the results of CSIRO and all controlled entities, regardless of whether they are within the GGS or not. Therefore, there is a difference in the accounting treatment between the two, resulting in the budget containing the Innovation Fund investment as an *Investment Accounted for using the Equity Method* (reported as Other investments), while the Financial Statements account for this investment in the consolidation as *Cash and cash equivalents* held by a controlled entity. Additionally, due to supply issues caused by COVID-19 restrictions, there was lower employee and supplier expenses and capital expenditure.

Other investments are higher than budget due to the acquisition of shares not foreseen at the time of preparing the budget, an increase in the valuation of the share portfolio, and the difference in basis of preparation between the PBS and the financial statements relating to the Innovation Fund investment.

The former CSIRO site at Belmont, Victoria has been recorded as a *Property held for sale* in the budget due to the impending finalisation of the sale of the land. At the time of developing the 2020-21 PBS, the land was expected to sell in 2020-21, however this did not occur.

Provision for remediation is higher than budget reflecting higher than previously estimated waste removal and site remediation costs.

Retained Surplus is higher than budget as the operating result for 2020-21 was positive in comparison to the budgeted loss.

The *Non-controlling interest* balance is higher than budget due to the difference in basis of preparation between the PBS and the financial statements relating to the Innovation Fund investment.

Cash Flow Statement

Variances relating to cash flows are a reflection of the factors detailed under Statement of Comprehensive Income and Statement of Financial Position.

Part 6

Science and Industry Endowment Fund

Trustee's report

SIEF Trustee, Dr Larry Marshall

Over the past year, I have reflected on the foresight of the Federal Parliament in the early 20th century to future proof and embed national resilience through science and technology, and how the Australian nation continues to benefit to this day.

In 1926, the Australian Government established the Science and Industry Endowment Fund (SIEF) to support the training of the nation's scientists for the benefit of the nation. Almost 100 years after the *Science and Industry Endowment Act 1926* was passed, SIEF remains true to its purpose of assisting Australian industry, furthering the interests of the Australian community and contributing to the achievement of Australia's national objectives. SIEF was established at the same time as CSIRO and is connected through the legislation. This connection endures today as SIEF and CSIRO work closely together, while SIEF still strongly retains its independence from CSIRO.

In both 1926 and 2020, the Australian Government recognised the need to boost the nation's manufacturing capabilities to deliver positive economic outcomes, through taking up research outcomes by industry and building STEM capability.

This year, SIEF continued to invest in science and technology that assists industry:

- Future National ICT Industry Platform: backing digital transformation to create new Australian technology-based industries that can reach global scale.
- SIEF Ross Metcalf STEM+Business Fellowships: connecting small- to medium-sized enterprises (SMEs) with research organisations, driving innovation and collaboration (read more about these fellowships on page 92).
- Experimental Development Program: accelerating the commercialisation of Australian developed technologies giving Australia a competitive advantage.
- Generation STEM initiative: attracting, supporting, retaining and training NSW students in STEM, creating an innovative STEM-skilled workforce essential for the growth of Australia and its economic prosperity. Read more about Generation STEM on pages 82 and 85.

Partnering businesses with research and development

A lack of connections can prevent businesses from collaborating with scientists and researchers on their problems to identify solutions. The SIEF Ross Metcalf STEM+Business Fellowships have been highly successful in breaking down barriers that exist between industry and research organisations. The program is managed by CSIRO, which has facilitated 42 early-career fellowships over the life of the program. This year, 6 new projects were contracted. Due to the successful outcomes of their initial projects, many SMEs have applied for a second project. An example of this is the SME Australian Bay Lobster Producers (ABLP), an aquaculture business that produces premium quality Moreton Bay bugs. A key concern for the company was monitoring their growth tanks to maintain the health of their animals. This was being undertaken manually, and there was a strong desire to improve the process through automation. The first fellowship developed a digital-vision software that is now integrated into ABLP's production facility and is providing significant operational benefits. After the success of the first fellowship, ABLP applied for a second fellowship to develop a probiotic lobster feed to make further improvements to its high-value food product.

Digital transformation of supply chains

To boost the value of exports and secure new agricultural markets, Australia needs to grow its high-value markets where global consumers will pay a premium for quality, safety and provenance. This requires building robust supply chains that deliver trusted products. Digitally transforming Australia's supply chains would enhance brand trust, privacy and efficiency for producers.

Through the Future National ICT Industry Platform Program, made possible through the NICTA Gift, SIEF is funding Digital Initiatives that are developing digital solutions to address supply chain integrity and food provenance. The Supply Chain Integrity Digital Initiatives have developed technologies that validate claims about the origin of a product, its authenticity and adherence to ethical production practices, and improves efficiency for primary producers. For instance, cattle farmers can benefit greatly from an automated farm provenance system that integrates a suite of novel technologies for on-farm data provenance, data trust and automated compliance.

The system is designed to provide trusted, auditable evidence of complying with industry regulations and guidelines. By adopting smart automated data collection technology, farmers and producers can automatically verify compliance, which replaces manual checks and reduces regulatory burdens. Read about the technology and its impact on page 208.

Industry focused science and technology

The CSIRO Gift's Experimental Development Program (EDP) commenced in 2015 to address a significant gap in funding options available for progressing technology to a stage suitable for attracting commercial investment and market uptake.

Developing new technologies that are backed by excellent science benefits Australian industries and gives them a competitive edge. To date, SIEF and its co-investors have funded 15 projects and a total of $36 million. Many of the collaborators are Australian SMEs.

The Megasonics EDP project successfully demonstrated that an increased amount of oil can be extracted from olive paste, and without the use of enzymes, by using high-frequency ultrasound standing waves (megasonics). This provides an opportunity to maximise oil recovery and increase the prospective market to countries where the enzymes are banned when producing extra virgin olive oil. The process also increases the content of phenolic compounds in the oil, which creates a healthier product. Financially, this means additional revenue from increased oil yields, reduced production costs at traditional yield levels and a higher quality product that can demand higher prices. This technology may also be applied to other oil feedstocks (such as palm oil), therefore increasing the market for this technology. Read about Megasonics and its impact on page 209.

In my role as SIEF Trustee, I am assisted by the advisory bodies and expert reviewers who generously contribute their time and expertise to SIEF to provide advice for funding decisions across the portfolio. I sincerely thank them for the advice they have provided this year.

Being an advisor, board member, and even a trustee can be a thankless task, but when I see everything we have delivered for our country, it's a task I give thanks for having the privilege to fulfil.

I am proud of what SIEF has achieved this year by assisting Australian industry, furthering the interests of the Australian community and contributing to supporting national objectives. I am confident it will continue to do so for the next 100 years so that we can see science and technology change the future and make life better for all Australians.

Dr Larry Marshall
SIEF Trustee

SIEF advisory bodies

CSIRO Gift Advisory Council Members

Emeritus Prof Alan Robson (Chair)
Dr Peter Riddles (Chair, EDP Review Panels)
Mr Nigel Poole
Dr Ezio Rizzardo
Professor Margaret Sheil
Professor Tom Spurling

Generation STEM Consultative Council

Mr David Wright (Chair)
Ms Maile Carnegie*
Mr Martin Graham*
Ms Chloe Read
Ms Gail Fulton
Dr Ian Oppermann
Dr Dave Williams

NICTA Program Advisory Council

Ms Michelle Price
Dr Jon Whittle
Mr John Paitaridis
Dr Simon Barry*

*Indicates retirement from the Councils.

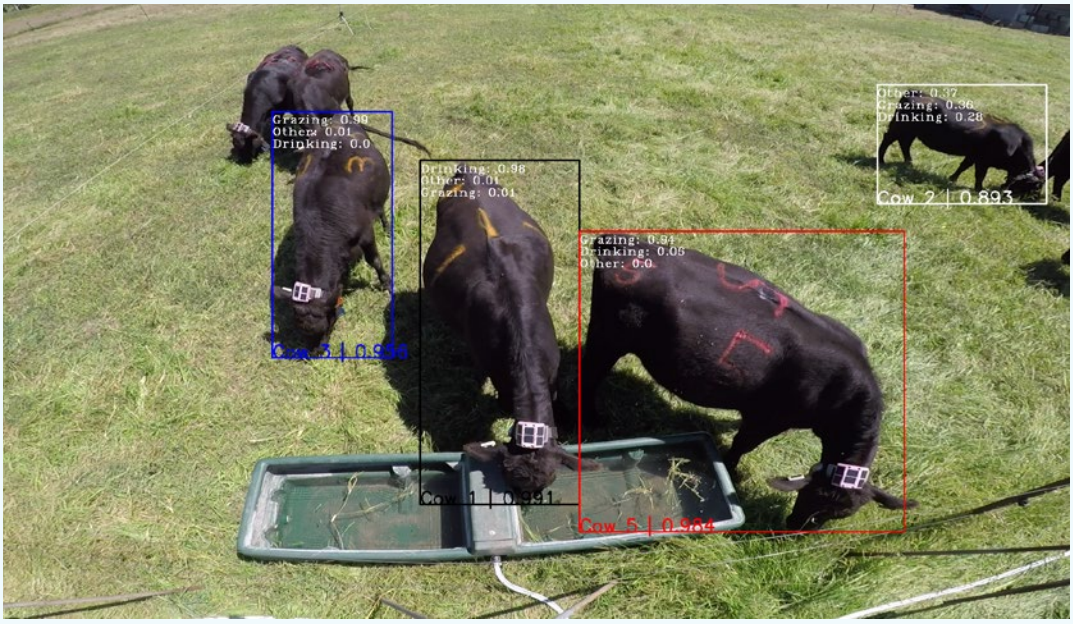
Automated and trusted compliance tools for food supply chains

There is an increasing demand for robust supply chains that deliver food that global consumers can trust. Boosting Australia's high-value food export markets where premiums are paid for quality, safety and provenance will require advanced digital solutions.

SIEF invested $2.4 million in the Automated Farm Provenance *work* package, part of a NICTA Gift funded Digital Initiative to develop new technologies to enhance supply chain integrity. The investment enabled a suite of new technologies to be integrated into a system greater than the sum of its parts, which culminated in a virtual demonstration to the Australian red meat industry in December.

The work developed a system to automatically verify compliance to guidelines and regulations on the farm for the red meat industry as a test case. The proof-of-concept combined a secure data provenance system (by storing data using a private Ethereum IoT Edge blockchain) with a data trust engine (calculating and validating reputation and data trust via multiple sources) with automatic determination of various animal welfare regulations using logic and rules based on data from livestock smart ear tags and data from the cloud.

The SIEF investment has created new intellectual property, research knowledge and capability for advancements in supply chain integrity. New CSIRO research and development efforts will continue this work with a focus on developing novel automated compliance tools and platforms for food export supply chains and animal monitoring systems for welfare and sustainability assurance. By developing new technologies that automatically verify compliance and monitor animal welfare, we can replace manual checks and reduce regulatory burdens across Australian supply chains and strengthen Australia's valuable reputation as a trusted and safe source of food.



Video cameras are used to determine if the animal is drinking enough water to comply with industry welfare standards.

Megasonics for enhanced virgin olive oil recovery

The olive oil industry faces constraints to existing physical extraction methods. Oil must be extracted immediately and is confined to a short window for processing olives, about two months per year. Since 2013, CSIRO has been investigating the application of Megasonics to olive oil extraction, and prior to 2018, had successfully demonstrated the technology up to 300 kilograms per hour.

Megasonics refers to the application of ultrasound waves in the high frequency range (>0.4 to several megahertz) to separate low density oil droplets from higher density solid particles. CSIRO previously developed the Megasonics technology to enhance oil recovery in vegetable oil processing streams and holds the global exclusive process patent to the technology.

SIEF's investment enabled a Megasonic reactor system to be designed and installed for commercial testing for the first time in olive oil processing. The investment enabled and advanced the technology readiness of Megasonics in olive oil by scaling and demonstrating the technology at 3,000 kilograms per hour with commercial partner, Boundary Bend. This financial investment was critical to progressing the research to the commercial testing phase.

The commercial trial demonstrated the potential of Megasonics to extract up to 3.7 per cent additional olive oil while still maintaining oil shelf life. Further, the technology was demonstrated to be able to produce existing oil yields but at a faster and more efficient rate.

The technology has promising potential in Australia's domestic olive oil industry, currently worth $512 million annually across approximately 120 producers, and globally, across approximately 800 processing plants. It presents an opportunity to improve olive oil processing productivity and possibly deliver health benefits through improved oil phenolic composition. SIEF's funding at a critical junction in the technology's development has paved the way for future commercial prototype development and will be a considerable legacy of the Experimental Development Program if it is adopted widely in the future.

Industrial 3 tonnes per hour Megasonics demonstration olive oil extraction.

Australian National Audit Office

INDEPENDENT AUDITOR'S REPORT

To the Minister for Industry, Science and Technology

Report on the annual financial statements

Opinion

In my opinion, the financial statements of the Science and Industry Endowment Fund (SIEF) for the year ended 30 June 2021:

(a) comply with Australian Accounting Standards – Reduced Disclosure Requirements and the *Science and Industry Endowment Act 1926*; and

(b) present fairly the financial position of SIEF as at 30 June 2021 and its financial performance and cash flows for the year then ended.

The financial statements of SIEF, which I have audited, comprise the following as at 30 June 2021 and for the year then ended:

- Statement by the Trustee and Chief Finance Officer of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) as Service Provider to SIEF;
- Statement of Comprehensive Income;
- Statement of Financial Position;
- Statement of Changes in Equity;
- Cash Flow Statement; and
- Notes to the financial statements, comprising a summary of significant accounting policies and other explanatory information

Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of SIEF in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) to the extent that they are not in conflict with the *Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Trustee's responsibility for the financial statements

The Trustee of SIEF is responsible under the *Science and Industry Endowment Act 1926* for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the rules made under the Act. The Trustee is also responsible for such internal control as the Trustee determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Trustee is responsible for assessing the ability of SIEF to continue as a going concern, taking into account whether SIEF's operations will cease as a result of an administrative restructure or for any other reason. The Trustee is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

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Phone (02) 6203 7300

Auditor's responsibilities for the audit of the financial statements

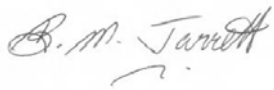
My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of SIEF's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Accountable Authority;
- conclude on the appropriateness of the Accountable Authority's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on SIEF's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause SIEF to cease to continue as a going concern; and
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

I communicate with the Trustee regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office



Brandon Jarrett

Senior Executive Director

Delegate of the Auditor-General

Canberra

11 August 2021

SCIENCE AND INDUSTRY ENDOWMENT FUND
STATEMENT OF COMPREHENSIVE INCOME
For the year ended 30 June 2021

	Notes	2021	2020
		$	$
EXPENSES			
Scientific research grants	2	**5,008,502**	11,546,425
Service fee under services agreement with CSIRO		**544,000**	578,064
Audit and bank fees		**15,500**	15,570
Other fees		**56,931**	3
Total expenses		**5,624,933**	12,140,062
REVENUE			
Gifts, bequests and donations	3	**18,000,000**	10,000,000
Interest	4	**548,880**	1,139,994
Total revenue		**18,548,880**	11,139,994
Net profit/ (deficit)		**12,923,947**	(1,000,068)
Other comprehensive income		**-**	-
Total comprehensive income/(loss)		**12,923,947**	(1,000,068)

The above statement should be read in conjunction with the accompanying notes.

SCIENCE AND INDUSTRY ENDOWMENT FUND
STATEMENT OF FINANCIAL POSITION
As at 30 June 2021

	Notes	2021	2020
		$	$
ASSETS			
Current assets			
Cash and cash equivalents	5	**77,698,752**	64,603,883
Trade and other receivables	6	**278,601**	465,023
Total assets		**77,977,353**	65,068,906
LIABILITIES			
Current liabilities			
Payables			
Accrued audit fee	7	-	15,500
Total payables		**-**	15,500
Total liabilities		**-**	15,500
Net assets		**77,977,353**	65,053,406
EQUITY			
Contributed equity		**200,000**	200,000
Retained surplus		**77,777,353**	64,853,406
Total equity		**77,977,353**	65,053,406

The above statement should be read in conjunction with the accompanying notes.

SCIENCE AND INDUSTRY ENDOWMENT FUND
STATEMENT OF CHANGES IN EQUITY
For the year ended 30 June 2021

	Retained Surplus		Contributed Equity		Total Equity	
	2021	2020	**2021**	2020	**2021**	2020
	$	$	**$**	$	**$**	$
Opening Balance	**64,853,406**	65,853,474	**200,000**	200,000	**65,053,406**	66,053,474
Net profit/(deficit)	**12,923,947**	(1,000,068)	**-**	-	**12,923,947**	(1,000,068)
Closing Balance	**77,777,353**	64,853,406	**200,000**	200,000	**77,977,353**	65,053,406

The above statement should be read in conjunction with the accompanying notes

SCIENCE AND INDUSTRY ENDOWMENT FUND
CASH FLOW STATEMENT
For the year ended 30 June 2021

	Notes	2021	2020
		$	$
OPERATING ACTIVITIES			
Cash received			
NICTA Gift		-	5,000,000
CSIRO Gift		**18,000,000**	5,000,000
Interest received		**807,312**	1,505,730
GST credits received		**492,033**	2,717,266
Total cash received		**19,299,345**	14,222,996
Cash used			
Payments to grantees		**5,509,352**	13,992,355
Other payments		**695,124**	644,321
Total cash used		**6,204,476**	14,636,676
Net cash provided/(used) by operating activities	8	**13,094,869**	(413,680)
Net increase/(decrease) in cash held		**13,094,869**	(413,680)
Cash at the beginning of the reporting period		**64,603,883**	65,017,563
Cash at the end of the reporting period		**77,698,752**	64,603,883

The above statement should be read in conjunction with the accompanying notes

SCIENCE AND INDUSTRY ENDOWMENT FUND
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT
For the year ended 30 June 2021

Note 1 Overview

The Science and Industry Endowment Fund (referred to as "the Fund") was established under the *Science and Industry Endowment Act 1926* with the Trustee of the Fund being the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Chief Executive and is a not-for-profit entity. An appropriation of 100,000 pounds was received at the time the Fund was established. The principal activity of the Fund is to provide assistance to persons engaged in scientific research and in the training of students in scientific research.

In October 2009 the Minister for Innovation, Industry, Science and Research announced a gift of $150 million to be donated by CSIRO to the Fund. The gift is intended to be used for scientific research for the purposes of assisting Australian industry and furthering the interests of the Australian community or contributing to the achievement of Australian national objectives. The gift was made subject to the terms of a Deed of Gift between the Trustee and CSIRO dated 15 October 2009. In 2018, 2020 and 2021, CSIRO made further gifts of $10 million, $5 million and $18 million respectively, to the Fund. These gifts were also made subject to the terms of the Deed of Gift between the Trustee and CSIRO dated 15 October 2009. The total cash payments made by the Fund in 2020-21 under the Deed of Gift were $2,807,338 (GST exclusive).

In June 2017, the NSW Government acting through the NSW Department of Industry provided a $25 million endowment to the Fund to create the NSW Generation STEM Program. The program will be delivered over a 10-year period and will implement activities including research, to increase the supply of STEM (science, technology, engineering and mathematics) skilled labour to meet the current and future needs of New South Wales. The total cash payments made by the Fund in 2020-21 under the NSW Endowment were $275,000 (GST exclusive).

In November and December 2018, National ICT Australia Limited (NICTA), a controlled entity of CSIRO, provided two gifts to the Fund in the total amount of $20 million to fund the Future National ICT Industry Platform Program. A further $5 million was provided to the Fund by NICTA in December 2019. The program is to support research activities and projects at a scale that address challenges in the field of information and communications technology (ICT) and it is intended that the outcomes from the Program will benefit Australia by helping create new Australian technology-based industries and/or applied technology platforms that can reach a global scale. The total payments made by the Fund in 2020-21 under the Future National ICT Industry Platform Program were $2,558,094 (GST exclusive).

In any one financial year a maximum amount of $25 million exclusive of Goods and Services Tax (GST) can be disbursed from the Fund for the CSIRO GIFT, NSW Generation STEM Program and the Future National ICT Industry Platform Program (under the Deeds of Gift/Endowment). The total payments made by the Fund under these gifts and programs in 2020-21 were $5,640,432 (GST exclusive).

Basis of Preparation of the Financial Statements
The financial statements for the Fund are general purpose financial statements and are required by:

- Section 10 of the *Science and Industry Endowment Act 1926.*

The financial statements have been prepared in accordance with:

- Australian Accounting Standards and Interpretations – Reduced Disclosure Requirements (Tier 2) issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and are in accordance with the historical cost convention. No allowance is made for the effect of changing prices on the results or the financial position. The financial statements are presented in Australian dollars and values are rounded to the nearest dollar unless otherwise specified.

SCIENCE AND INDUSTRY ENDOWMENT FUND
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT
For the year ended 30 June 2021

Note 1 Overview (continued)

Key Judgements and Estimates
The accounting policies are set out below. Within the current financial year, there were no significant management judgements or estimates used in the preparation of the financial statements.

New Australian Accounting Standards
All new/revised/amending standards and/or interpretations that were issued prior to the sign-off date and applicable to the current reporting period did not have any impact on the financial statements of the Fund.

Taxation
The Fund is exempt from all forms of taxation except Goods and Services Tax ('GST').

Events after the Reporting Period
At the time of signing of the financial statements, the Trustee is not aware of any other significant events occurring after the reporting date that could impact on the financial report.

Note 2 Scientific Research Grants

	2021	2020
	$	$
Future National ICT Industry Platform Program	**2,288,094**	7,694,540
Research Infrastructure Investment	**200,000**	990,000
Promotion of Science Program - Scholarships and Fellowships	**100,000**	607,848
Experimental Development Program	**2,220,408**	2,254,037
NSW Endowment Grant	**200,000**	-
Total	**5,008,502**	11,546,425

Accounting Policy
The Fund awards grants to support approved eligible applications in instalments, subject to the completion by Grant Recipients of funding milestones which are verified through provision of satisfactory Progress Reports to the Fund Manager. All costs associated with providing Scientific Research Grants are expensed at acceptance of relevant Progress Report.

The Fund is a subsidiary entity of CSIRO. For the 2020-21 financial year, the Fund has recognised $5 million in grant expenses as transferred directly to CSIRO to support scientific research and infrastructure projects within CSIRO and/or collaborative projects with external organisations (2019-20: $11.5m).

SCIENCE AND INDUSTRY ENDOWMENT FUND
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT
For the year ended 30 June 2021

Note 3 Revenue from Gifts, Bequests and Donations

	2021	2020
	$	$
NICTA Gift	**-**	5,000,000
CSIRO Gift	**18,000,000**	5,000,000
Total	**18,000,000**	10,000,000

Accounting Policy
Gifts, bequests and donations are recognised as revenue when the entity gains control of the funds, where the consideration to acquire an asset is significantly less than fair value. Except for certain amounts that relate to activities that are reciprocal in nature, in which case revenue is recognised only when it has been earned. Gifts, bequests or donations receivable are recognised at their nominal amounts as a financial asset under *AASB9 Financial Instruments* as highlighted in paragraph 8 of *AASB1058 Income of Not-for-Profit Entities*.

The $18 million gift received from CSIRO is to be used to further Fund objectives.

Note 4 Interest Revenue

	2021	2020
	$	$
Cash bank account interest	**61,998**	108,489
Term deposits interest	**486,882**	1,031,505
Total	**548,880**	1,139,994

Accounting Policy
Interest revenue is recognised using the effective interest method as set out in *AASB9 Financial Instruments.*

Note 5 Cash and Cash Equivalents

	2021	2020
	$	$
Cash at bank	**30,648,752**	14,118,883
Term deposits	**47,050,000**	50,485,000
Total	**77,698,752**	64,603,883

Accounting Policy
Cash and cash equivalents include cash on hand and demand deposits in bank accounts with an original maturity of twelve months or less that are readily convertible to known amounts of cash and subject to insignificant risk of change in value. Cash is recognised at its nominal amount.

SCIENCE AND INDUSTRY ENDOWMENT FUND
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT
For the year ended 30 June 2021

Note 6 Trade and Other Receivables

	2021	2020
	$	$
Interest receivable	**169,757**	428,189
GST receivable	**108,844**	36,834
Total receivables	**278,601**	465,023
Less impairment loss allowance	**-**	-
Total trade and other receivables	**278,601**	465,023

Accounting Policy
Trade receivables are financial assets held for collecting the contractual cash flows of the asset, where the cash flows are solely payments of principal and interest that are not provided at below-market interest rates. They are subsequently measured at amortised cost using the effective interest method adjusted for any loss allowance.

Note 7 Accrued Expenses

	2021	2020
	$	$
Audit Fee	**-**	15,500
Total	**-**	15,500

Accounting Policy
In 2020-21 audit fees were included and paid as part of service fees to CSIRO.

Note 8 Cash Flow Reconciliation

	2021	2020
	$	$
Reconciliation of operating surplus to net cash from/(used by) operating activities:		
Operating surplus/(deficit)	**12,923,947**	(1,000,068)
Changes in assets and liabilities		
Decrease/(increase) in receivables	**186,422**	1,752,402
Increase/(decrease) in payables	**(15,500)**	(1,166,014)
Net cash from/(used by) operating activities	**13,094,869**	(413,680)

Note 9 Contingent Assets and Liabilities

No contingent assets or liabilities existed as at 30 June 2021 (2020: nil).

SCIENCE AND INDUSTRY ENDOWMENT FUND
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT
For the year ended 30 June 2021

Note 10 Related Party Disclosures

The Fund is a wholly controlled subsidiary of CSIRO. The Trustee is the Chief Executive of CSIRO who is remunerated through CSIRO and not paid an additional salary for his role as Trustee of the Fund. There were no transactions during the reporting period between the Trustee and the Fund. Related parties to this entity other than the Trustee are other Australian Government entities.

Significant transactions with related parties can include the payment of grants, the purchase of goods and services. In considering relationships with related entities, and transactions entered into during the reporting period by the Fund, it has been determined that there are no related party transactions required to be separately disclosed. Grants are awarded based on assessment against a set of established selection criteria prior to approval. All eligible applications are assessed equally.

Note 11 Schedule of Commitments

The below table shows the monies the Fund is committed to pay on its executed grant funding agreements as at 30 June 2021, subject to grantees meeting funding milestones.

	2021	2020
	$	$
BY TYPE		
Grants commitments payable	**31,724,140**	38,557,048
GST receivable on grants payable	**(2,884,013)**	(3,505,186)
Total net commitments by type	**28,840,127**	35,051,862
BY MATURITY		
Grant commitments payable		
One year or less	**8,453,552**	13,270,964
From one to five years	**15,240,588**	18,851,084
More than five years	**8,030,000**	6,435,000
Total grants payable	**31,724,140**	38,557,048
GST commitments receivable		
One year or less	**(768,505)**	(1,206,451)
From one to five years	**(1,385,508)**	(1,713,735)
More than five years	**(730,000)**	(585,000)
Total commitments receivable	**(2,884,013)**	(3,505,186)
Net commitments by maturity	**28,840,127**	35,051,862

SCIENCE AND INDUSTRY ENDOWMENT FUND
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT
For the year ended 30 June 2021

Note 12 Financial Instruments of the Financial Statements

Note 12.1 Categories of Financial Instruments

	2021	2020
	$	$
Categories of financial instruments		
Financial assets under AASB 9		
Financial assets at amortised cost		
Cash and cash equivalents	77,698,752	64,603,883
Interest receivable	169,757	428,189
GST receivable	108,844	36,834
Total financial assets at amortised cost	**77,977,353**	65,068,906
Total financial assets	**77,977,353**	65,068,906
Financial liabilities		
Financial liabilities at amortised cost		
Accrued audit fee	-	15,500
Total financial liabilities at amortised cost	-	15,500
Total financial liabilities	-	15,500

Note 12.1 Categories of Financial Instruments (continued)

Accounting Policy

Financial Assets

The Fund classifies its financial assets under *AASB9 Financial Instruments* as financial assets measured at amortised cost.

The classification depends on both the entity's business model for managing the financial assets and contractual cash flow characteristics at the time of initial recognition. Financial assets are recognised when the entity becomes a party to the contract and, as a consequence, has a legal right to receive or a legal obligation to pay cash and derecognised when the contractual rights to the cash flows from the financial asset expire or are transferred upon trade date.

Financial Assets at Amortised Cost

Financial assets included in this category need to meet two criteria:

1. the financial asset is held in order to collect the contractual cash flows; and

2. the cash flows are solely payments of principal and interest (SPPI) on the principal outstanding amount.

Amortised cost is determined using the effective interest method.

Effective Interest Method

Income is recognised on an effective interest rate basis for financial assets that are recognised at amortised cost.

Financial liabilities

Financial liabilities are classified as either financial liabilities 'at fair value through profit or loss' or other financial liabilities. Financial liabilities are recognised and derecognised upon 'trade date'.

Financial Liabilities at Amortised Cost

Financial liabilities, including borrowings, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

Supplier and other payables are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

Note 12.2 Net Income and Expenses from Financial Assets

	2021	2020
	$	$
Interest revenue	**548,880**	1,139,994
Total	**548,880**	1,139,994

SCIENCE AND INDUSTRY ENDOWMENT FUND
DIRECTORS DECLARATION
For the year ended 30 June 2021

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT BY THE TRUSTEE AND CHIEF FINANCE OFFICER OF COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO) AS SERVICE PROVIDER TO THE SCIENCE AND INDUSTRY ENDOWMENT FUND

The attached financial report for the year ended 30 June 2021 has been prepared based on properly maintained financial records and in accordance with Australian Accounting Standards and other mandatory financial reporting requirements in Australia, and gives a true and fair view of the financial position of the Science and Industry Endowment Fund as at 30 June 2021 and of its performance for the year then ended.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Science and Industry Endowment Fund will be able to pay its debts as and when they become due and payable.

Larry Marshall

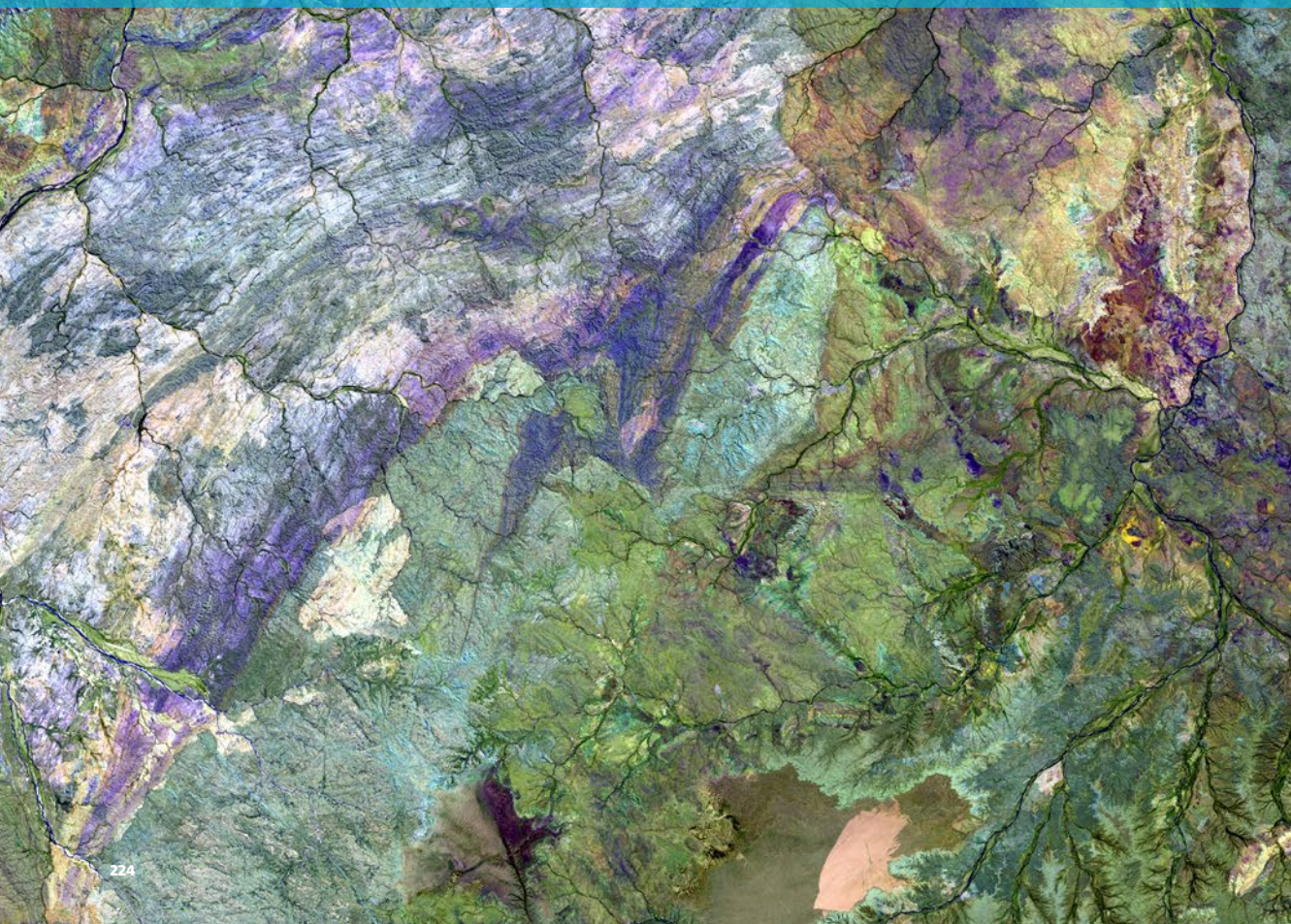
Trustee of the Science and
Industry Endowment Fund

10 August 2021

Tom Munyard

Chief Finance Officer of CSIRO
as service provider to the Science and Industry
Endowment Fund

10 August 2021



Part 7

Appendices and indexes

Data templates

Appendix A: Management of human resources

All ongoing employees current report period (2020–21)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	375	17	392	179	67	246	–	–	–	638
QLD	370	9	379	218	56	274	–	–	–	653
SA	101	5	106	86	33	119	–	–	–	225
TAS	195	6	201	93	21	114	–	–	–	315
VIC	657	22	679	372	115	487	1	–	1	1,167
WA	242	8	250	91	38	129	1	–	1	380
ACT	448	21	469	296	87	383	–	–	–	852
NT	7	1	8	4	3	7	–	–	–	15
External territories	–	–	–	–	–	–	–	–	–	–
Overseas	–	–	–	–	–	–	–	–	–	–
Total	**2,395**	**89**	**2,484**	**1,339**	**420**	**1,759**	**2**	–	**2**	**4,245**

All non-ongoing employees current report period (2020–21)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	95	14	109	50	26	76	2	–	2	187
QLD	99	23	122	61	21	82	2	–	2	206
SA	21	1	22	21	6	27	–	–	–	49
TAS	21	2	23	18	5	23	–	–	–	46
VIC	115	11	126	79	22	101	2	–	2	229
WA	45	6	51	36	10	46	–	–	–	97
ACT	70	77	81	52	20	72	–	–	–	153
NT	2	1	3	1	2	3	–	–	–	6
External territories	–	–	–	–	–	–	–	–	–	–
Overseas	1	–	1	2	–	2	–	–	–	3
Total	**469**	**69**	**538**	**320**	**112**	**432**	**6**	**–**	**6**	**976**

All ongoing employees previous report period (2019–20)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	407	21	428	189	77	266	–	–	–	694
QLD	370	10	380	208	61	269	–	–	–	649
SA	95	6	101	86	30	116	–	–	–	217
TAS	196	8	204	92	23	115	–	–	–	319
VIC	669	24	693	359	18	477	1	–	1	1,171
WA	242	5	247	90	39	129	1	–	1	377
ACT	479	18	497	309	96	405	–	–	–	902
NT	4	1	5	2	3	5	–	–	–	10
Overseas	–	–	–	–	–	–	–	–	–	–
Total	**2,462**	**93**	**2,555**	**1,335**	**447**	**1,782**	**2**	**–**	**2**	**4,339**

All non-ongoing employees previous report period (2019–20)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	110	13	123	51	22	73	–	–	–	196
QLD	111	16	127	49	18	67	1	–	1	195
SA	25	2	27	21	5	26	–	–	–	53
TAS	30	5	35	22	7	29	–	–	–	64
VIC	93	11	104	73	19	92	1	–	1	197
WA	52	7	59	37	7	44	–	–	–	103
ACT	83	10	93	57	13	70	–	1	1	164
NT	2	–	2	1	–	1	–	–	–	3
Overseas	3	–	3	2	–	2	–	–	–	5
Total	**509**	**64**	**573**	**313**	**91**	**404**	**2**	**1**	**3**	**980**

Appendix B: Accountable authority

Details of accountable authority during the current report period (2020–21)

NAME	QUALIFICATIONS OF THE ACCOUNTABLE AUTHORITY	EXPERIENCE OF THE ACCOUNTABLE AUTHORITY
Mr David Thodey AO	BA FAICD	Mr Thodey is a business leader and company director focused on innovation, technology and digital, with more than 30 years' experience, including as Chief Executive Officer of Telstra and Chief Executive Officer of IBM Australia and New Zealand. An experienced board director and Chair, his current positions include director of Ramsay Health Care and Chair of Tyro Payments Ltd and Xero Limited.
Dr Larry Marshall	BSc (Hons) PhD GAICD FTSE	Dr Marshall is a scientist, technology innovator and business leader with over 25 years' experience in creating new value and impact with science. He founded 6 successful companies in biotechnology, photonics, telecommunications and semiconductors in the United States, and has served on 20 boards of high-tech companies operating in the United States, Australia and China. Dr Marshall believes CSIRO is the essential catalyst to improve Australia's innovation performance.
Ms Kathryn Fagg AO	BE (Hons) Chem Eng and MCom (Hons) FTSE GAICD	Ms Fagg, an experienced director, senior executive and engineer, has worked in logistics, manufacturing, resources, banking and professional services, including with Linfox, BlueScope Steel, and the ANZ Banking Group. She also served on the Board of the Reserve Bank of Australia. Her current board positions include Chair of Boral to 30 July 2021 and Breast Cancer Network Australia and member of the boards of Myer Foundation, National Australia Bank and Djerriwarrh Investments.
Dr Michelle Allan	BAppSc MMgtTec MCommLaw DBA FAICD	Dr Allan is an experienced company director with significant skills and competencies in the university, private and public sectors and expertise in food and advanced manufacturing. Her background is in biomedical science, management and law. Dr Allan's current positions as Chair include Apple and Pear Australia, Charles Sturt University, Food and Agribusiness Growth Centre, Defence CRC for Trusted Autonomous Systems and Wine Australia. She is also a Director of the Food Agility CRC, Dairy Food Safety Victoria, MJCP Holdings Pty Ltd and SmartSat CRC.
Mr Drew Clarke AO	PSM BAppSc (Surveying) MSc GAICD FTSE	Mr Clarke is a company director offering applied science, public policy and government administration expertise from over 20 years in senior roles in the Australian Public Service, including as Secretary of the Department of Resources, Energy and Tourism, Secretary of the Department of Communications and Chief of Staff in the Office of the Prime Minister. He is Chair of Australian Energy Market Operator Ltd, a director or NBNCo and a member of the Commonwealth Low Emission Technology Investment Advisory Council. Mr Clarke also chairs advisory groups relating to energy transition research and Antarctic science research.

		PERIOD AS THE ACCOUNTABLE AUTHORITY OR MEMBER WITHIN THE REPORTING PERIOD		
	POSITION TITLE/ POSITION HELD EXECUTIVE/NON-EXECUTIVE	COMMENCEMENT DATE	CESSATION DATE	NUMBER OF MEETINGS ACCOUNTABLE AUTHORITY ATTENDED
	Chairman Non-executive	15 October 2015	14 October 2021	8 of 8 meetings
	Chief Executive Executive	1 January 2015	30 June 2023	8 of 8 meetings
	Deputy Chair Non-executive	2 August 2018	16 September 2025	8 of 8 meetings
	Member Non-executive	5 May 2016	4 May 2024	8 of 8 meetings
	Member Non-executive	24 August 2017	23 August 2022	8 of 8 meetings

NAME	QUALIFICATIONS OF THE ACCOUNTABLE AUTHORITY	EXPERIENCE OF THE ACCOUNTABLE AUTHORITY
Professor Edwina Cornish AO	BSc (Hons) PhD FTSE AICD	Professor Cornish is a director with senior executive experience in research and higher education. She brings vast experience in the interface between government, research, science and higher education and provides strong business, industry and financial skills. Professor Cornish played a key role in building one of Australia's first biotechnology companies, Florigene Limited, which developed and commercialised the world's first genetically modified flowers. She is on the Council of La Trobe University, the Chair of the University of Queensland – Indian Institute of Technology Delhi Academy Strategic Research Advisory Council, and a member of Biosciences Research Centre joint venture and Biosciences Research Centre Pty Ltd.
Mr David Knox	BSc (Hons) Mech Eng MBA FIE Aust FTSE GAICD	Mr Knox, an experienced company director with background in oil and gas, was formerly the Managing Director and Chief Executive of Australian Naval Infrastructure (to 3 April 2020), and Chief Executive Officer and Managing Director of Santos Limited (2008–15). He is currently Chair of Snowy Hydro Limited, and the Australian Centre for Social Innovation, and a Director of Migration Council Australia, Adelaide Festival Board, Redflow and Micro X.
Professor Tanya Monro	BSc (Hons) PhD FAA FTSE FOSA FAIP GAICD	Professor Monro is the Australian Chief Defence Scientist. She was previously Deputy Vice Chancellor Research and Innovation and an Australian Research Council Georgina Sweet Laureate Fellow at the University of South Australia. Her executive experience in industry and education includes research in photonics focusing on sensing, lasers and new classes of optical fibres. Professor Monro is a director of Red Chip Photonics, Science Patron of the National Youth Science Forum, and a member of the South Australian Premier's Economic Advisory Council and National Committee for Physics.
Dr Peter Riddles AM	BSc (Hons) PhD Grad Dip Bus FAICD	Dr Riddles is an experienced company director and advisor. He has worked as a research scientist in molecular biology in the public sector including CSIRO, on commercialisation and new venture creation and government policy development. His expertise is in biotechnology and entrepreneurship in higher education and research. His other roles include member of the Science and Industry Endowment Fund (SIEF) Advisory Council, Chair of SIEF Advisory Council Experimental Development Program Committee, Chair of Infrastructure CoLaboratory Advisory Board and director of Hear and Say Centre for Deaf Children Ltd.
Professor Michelle Simmons AO	BSc Physics (Hons) BSc Chemistry (Hons) PhD FRS FAA FAAAS FTSE FInstP Dist FRNS	Professor Simmons is Director of the Centre of Excellence for Quantum Computation and Communication Technology at the University of New South Wales and Founder and Director of Silicon Quantum Computing. She has pioneered new technologies to build computing devices at the atomic scale. Professor Simmons has been recognised by the American Computer Museum as a pioneer in quantum computing and was awarded the US Feynman Prize in Nanotechnology. She is a member of the University Research Commercialisation Scheme Taskforce and National Intelligence Scientific Advisory Board.

		PERIOD AS THE ACCOUNTABLE AUTHORITY OR MEMBER WITHIN THE REPORTING PERIOD		
	POSITION TITLE/ POSITION HELD EXECUTIVE/NON-EXECUTIVE	COMMENCEMENT DATE	CESSATION DATE	NUMBER OF MEETINGS ACCOUNTABLE AUTHORITY ATTENDED
	Member Non-executive	26 November 2015	25 November 2023	8 of 8 meetings
	Member Non-executive	5 May 2016	4 May 2024	7 of 8 meetings
	Member Non-executive	25 February 2016	24 February 2024	8 of 8 meetings
	Member Non-executive	24 April 2014	23 April 2022	8 of 8 meetings
	Member Non-executive	17 September 2020	16 September 2025	2 of 3 meetings

Appendix C: CSIRO Board Audit and Risk Committee

MEMBER NAME	QUALIFICATIONS, KNOWLEDGE, SKILLS OR EXPERIENCE	NUMBER OF MEETINGS ATTENDED/TOTAL NUMBER OF MEETS	TOTAL ANNUAL REMUNERATION
Dr Michele Allan	BAppSc MMgtTec MCommLaw DBA FAICD Significant experience as director and senior executive in private, public and tertiary sector	4/4	$8,160 per annum (Remuneration Tribunal determination). Details of remuneration as a CSIRO Board member are in Note 3.3 of the Financial statements.
Mr Drew Clarke AO	BAppSc (Surveying) MSc GAICD FTSE Valuable mix of skills and experience in applied science, public policy and government administration	4/4	$8,160 per annum (Remuneration Tribunal determination). Details of remuneration as a CSIRO Board member are in Note 3.3 of the Financial statements.
Professor Edwina Cornish AO	BSc (Hons) PhD FTSE AICD Valuable skills and experience as a senior executive in the tertiary and commercial sector	4/4	$8,160 per annum (Remuneration Tribunal determination) Details of remuneration as a CSIRO Board member are in Note 3.3 of the Financial statements.
Ms Kathryn Fagg AO **Appointed as Chair of BARC on 28 June 2020**	BE (Hons) Chem Eng and MCom (Hons) FTSE GAICD Highly regarded director currently on the NAB Board. Brings skills and experience from the private and public sector	4/4	$16,320 per annum (Remuneration Tribunal determination). Details of remuneration as a CSIRO Board member are in Note 3.3 of the Financial statements.
Dr Peter Riddles AM	BSc (Hons) PhD Grad Dip Bus FAICD An experienced director to diverse organisations, including biotechnology start-up companies, industry organisations and University Commercial Offices	4/4	$8,160 per annum (Remuneration Tribunal determination). Details of remuneration as a CSIRO Board member are in Note 3.3 of the Financial statements.

Appendix D: Meetings of the Board and Board Committees

During 2020–21, 8 Board meetings (2 out of session), 4 Board Audit and Risk Committee meetings, 4 Board People and Safety Committee meetings and 4 Board Science Excellence Committee Meetings were held. The number of meetings attended by each of the Board members was as follows:

BOARD MEMBER	CSIRO BOARD		CSIRO BOARD AUDIT AND RISK COMMITTEE	
	NUMBER ELIGIBLE TO ATTEND AS A MEMBER	NUMBER ATTENDED	NUMBER ELIGIBLE TO ATTEND AS A MEMBER	NUMBER ATTENDED
David Thodey	8	8	–	4
Larry Marshall	8	8	–	4
Kathryn Fagg	8	8	4	4
Michele Allan	8	4	4	4
Drew Clarke	8	8	4	4
Edwina Cornish	8	8	4	4
David Knox	8	7	–	3
Tanya Monro	8	8	–	–
Peter Riddles	8	8	4	4
Michelle Simmons	3	2	–	–

BOARD MEMBER	CSIRO BOARD PEOPLE AND SAFETY COMMITTEE		CSIRO BOARD SCIENCE EXCELLENCE COMMITTEE	
	NUMBER ELIGIBLE TO ATTEND AS A MEMBER	NUMBER ATTENDED	NUMBER ELIGIBLE TO ATTEND AS A MEMBER	NUMBER ATTENDED
David Thodey	4	4	–	4
Larry Marshall	–	4	–	4
Kathryn Fagg	4	4	–	2
Michele Allan	–	1	4	4
Drew Clarke	4	4	–	4
Edwina Cornish	–	3	4	4
David Knox	4	4	4	3
Tanya Monro	4	4	4	4
Peter Riddles	–	3	4	4
Michelle Simmons	–	–	–	–

Acronyms

AAHL	Australian Animal Health Laboratory
ACDP	Australian Centre for Disease Preparedness
AI	Artificial intelligence
ALA	Atlas of Living Australia
APS	Australian Public Service
ASEAN	Association of Southeast Asian Nations
ASKAP	Australian Square Kilometre Array Pathfinder
ASTRI	Australian Solar Thermal Research Institute
ASX	Australian Securities Exchange
ATCA	Australia Telescope Compact Array
ATNF	Australia Telescope National Facility
CCS	Carbon capture and storage
CDSCC	Canberra Deep Space Communication Complex
CERC	CSIRO Early Research Career
CPRs	Commonwealth procurement rules
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water and the Environment
DFAT	Department of Foreign Affairs and Trade
DISER	Department of Industry, Science, Energy and Resources
eDNA	Environmental DNA
EDP	Experimental Development Program
ESD	Enterprise Support Digitalisation Program
ET	CSIRO Executive Team
FOI Act	*Freedom of Information Act 1982*
FSP	Future Science Platform
FTE	Full-time equivalent
GDP	Gross Domestic Product
HPC	High-Performance Computing
I^2S^2	Inquiry for Indigenous Science Students program
ICT	Information and communication technology
IP	Intellectual property
LiDAR	Light imaging, detection and ranging
MNF	Marine National Facility
MOU	Memoranda of understanding
NASA	National Aeronautics and Space Administration
NCI	Normalised Citation Index
NCRIS	National Collaborative Research Infrastructure Strategy
NICTA	National Information Communication and Technology Australia
NPS	Net Promoter Score
NRCA	National Research Collections Australia
OA	Open Access
PGPA	*Public Governance, Performance and Accountability Act 2013*
PID Act	*Public Interest Disclosure Act 2013*
PPE	Personal Protective Equipment
PV	Photovoltaic
R&D	Research and development
RDCs	Rural Research and Development Corporations
SAGE	Science in Australia Gender Equity
SIEF	Science and Industry Endowment Fund
SIR Act	*Science and Industry Research Act 1949*
SKA	Square Kilometre Array
SME	Small to medium-sized enterprise
STEM	Science, technology, engineering and mathematics
UROP	Undergraduate Research Opportunities Program

Glossary

Granted patents: Once a patent application has been examined and satisfies various patentability criteria, it becomes a granted patent. It remains a granted patent until the end of the patent period (normally 20 years), provided renewal fees are paid.

Journal articles: Includes journal articles and other items published as part of a journal (for example, an editorial or book review).

Live patent cases: A live patent case is where either a patent application or a granted patent exists. It does not include cases that have lapsed, expired or been withdrawn. Applications may include provisional applications, Patent Cooperation Treaty (PCT) applications and applications pending in Australia or foreign jurisdictions.

Physical Containment level 4 (PC4) laboratories: laboratories rated at the highest level of containment and the highest designated biosecurity level for working with highly transmissible diseases and viruses for which there is no vaccines or effective treatment.

PCT applications: International PCT applications are a 'temporary' phase in any international patenting process and these have a life span of 18 months. This type of application is very common in major international corporations and is used by CSIRO when it considers its invention may have wide commercial application. In view of the 18-month time span, it is reasonable to approximate that two-thirds of the reported number were filed in the previous 12-month period.

Recordable injury frequency rate: This is calculated as the sum of Lost Time Injuries per million hours worked plus Medical Treatment Injuries per million hours worked.

Science excellence: An assessment of the competitiveness of CSIRO's research capabilities. It recognises CSIRO's science (for example, total citations) and excellence (for example, citation rates). It tends to be output-oriented and includes lagging metrics relating to research publication performance (bibliometrics), esteem measures, such as awards, and expert-peer reviews.

Scope 1, 2 and 3 greenhouse gas emissions: Greenhouse gas emissions are organised into scopes to avoid double-counting emissions and indicate those that organisations can control (Scope 1) versus those that they can influence (Scope 3). Scope 1 are emissions from sources that are owned or controlled by the organisation. Scope 2 are emissions from the consumption of purchased electricity, steam, or other sources of energy generated upstream from the organisation. Scope 3 are emissions that are a consequence of the operations of an organisation, but are not directly owned or controlled by the organisation.

Sponsored students: Students are deemed to be sponsored if they receive a full or partial scholarship paid from CSIRO funds to pursue a research project leading to a PhD, master's or Honours degree. This excludes CSIRO employees, whose study expenses are considered to be training and development.

SIEF Ross Metcalf STEM+ Business Fellowship program: Run through the Science and Industry Endowment Fund, the program embeds early career researchers into an industrial workplace over a 2- to 3-year period.

Supervised students: Students are deemed to be supervised if they have a CSIRO staff member appointed officially by the university as a co-supervisor for their research project. Normally, CSIRO staff are joint supervisors in conjunction with a university academic.

Team Australia: An initiative to develop strategic partnerships with other government agencies such as the Department of Foreign Affairs and Trade, the Department of Industry, Energy, Science and Resources, and Austrade. It ensures we are working with these agencies to address complex, multidisciplinary challenges that require science and innovation input to support Australia's foreign policy agenda.

Technical reports: Includes individually authored chapters as well as whole reports that are subject to peer review and usually publicly released.

Telehealth: The use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration.

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PGPA RULE REFERENCE	PART OF REPORT	DESCRIPTION	REQUIREMENT
17BE	Contents of annual report		
17BE(a)	140	Details of the legislation establishing the body	Mandatory
17BE(b)(i)	6–7, 140	A summary of the objects and functions of the entity as set out in legislation	Mandatory
17BE(b)(ii)	36–37	The purposes of the entity as included in the entity's corporate plan for the reporting period	Mandatory
17BE(c)	140	The names of the persons holding the position of responsible Minister or responsible Ministers during the reporting period, and the titles of those responsible Ministers	Mandatory
17BE(d)	141	Directions given to the entity by the Minister under an Act or instrument during the reporting period	If applicable, mandatory
17BE(e)	140	Any government policy order that applied in relation to the entity during the reporting period under section 22 of the Act	If applicable, mandatory
17BE(f)	140	Particulars of noncompliance with: (a) a direction given to the entity by the Minister under an Act or instrument during the reporting period; or (b) a government policy order that applied in relation to the entity during the reporting period under section 22 of the Act	If applicable, mandatory
17BE(g)	36–132	Annual performance statements in accordance with paragraph 39(1)(b) of the Act and section 16F of the rule	Mandatory
17BE(h), 17BE(i)	140	A statement of significant issues reported to the Minister under paragraph 19(1)(e) of the Act that relates to noncompliance with finance law and action taken to remedy noncompliance	If applicable, mandatory
17BE(j)	36, 228–231	Information on the accountable authority, or each member of the accountable authority, of the entity during the reporting period	Mandatory
17BE(k)	136–137	Outline of the organisational structure of the entity (including any subsidiaries of the entity)	Mandatory
17BE(ka)	134, 226–227	Statistics on the entity's employees on an ongoing and non-ongoing basis, including the following: (a) statistics on fulltime employees; (b) statistics on part time employees; (c) statistics on gender; (d) statistics on staff location	Mandatory
17BE(l)	74–75, 135	Outline of the location (whether or not in Australia) of major activities or facilities of the entity	Mandatory
17BE(m)	141–153	Information relating to the main corporate governance practices used by the entity during the reporting period	Mandatory

PGPA RULE REFERENCE	PART OF REPORT	DESCRIPTION	REQUIREMENT
17BE(n), 17BE(o)	147	For transactions with a related Commonwealth entity or related company where the value of the transaction, or if there is more than one transaction, the aggregate of those transactions, is more than $10,000 (inclusive of GST): (a) the decision making process undertaken by the accountable authority to approve the entity paying for a good or service from, or providing a grant to, the related Commonwealth entity or related company; and (b) the value of the transaction, or if there is more than one transaction, the number of transactions and the aggregate of value of the transactions	If applicable, mandatory
17BE(p)	114, 117, 119, 123, 130	Any significant activities and changes that affected the operation or structure of the entity during the reporting period	If applicable, mandatory
17BE(q)	150	Particulars of judicial decisions or decisions of administrative tribunals that may have a significant effect on the operations of the entity	If applicable, mandatory
17BE(r)	122, 150	Particulars of any reports on the entity given by: (a) the Auditor General (other than a report under section 43 of the Act); or (b) a Parliamentary Committee; or (c) the Commonwealth Ombudsman; or (d) the Office of the Australian Information Commissioner	If applicable, mandatory
17BE(s)	N/A	An explanation of information not obtained from a subsidiary of the entity and the effect of not having the information on the annual report	If applicable, mandatory
17BE(t)	148	Details of any indemnity that applied during the reporting period to the accountable authority, any member of the accountable authority or officer of the entity against a liability (including premiums paid, or agreed to be paid, for insurance against the authority, member or officer's liability for legal costs)	If applicable, mandatory
17BE(taa)	141, 232–233	The following information about the audit committee for the entity: (a) a direct electronic address of the charter determining the functions of the audit committee; (b) the name of each member of the audit committee; (c) the qualifications, knowledge, skills or experience of each member of the audit committee; (d) information about each member's attendance at meetings of the audit committee; (e) the remuneration of each member of the audit committee	Mandatory
17BE(ta)	184–186	Information about executive remuneration	Mandatory

PGPA Rule Section 17BE (h) – (i) Significant non-compliance with Finance Law

DESCRIPTION OF NON-COMPLIANCE	REMEDIAL ACTION
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Feedback

CSIRO welcomes your feedback on our performance. Please contact the CSIRO officer with whom you have been dealing or CSIRO Enquiries, who can direct your feedback to the relevant person:
csiro.au/contact

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