Annual Report 2017–18

Australia's innovation catalyst

In partnership with Mining3, we have developed a software platform that can create and simulate a virtual mine. By positioning precisely where things are underground, it opens up opportunities such as controlling robots and tracking movement of ore of different grades.

About this report

This annual report is a summary of CSIRO's activities and financial position for the 12 month period ended 30 June 2018. As Australia's national science agency we address our greatest challenges through science and technology, delivering impacts that benefit our community, industry and the environment.

The report is also available at **www.csiro.au/annualreport2018**

COVER: Graphair, our specially designed graphene water filter, is transforming lengthy, multi-stage water purification into a highly efficient single step. The filter, tested in Sydney Harbour, removed 99 per cent more contaminants than similar products.

The innovation was first identified through ON, our national science and technology accelerator program, funded through the National Science and Innovation Agenda. The technology is receiving worldwide attention with over 110 partner enquiries including the International Red Cross and industries across the globe.

www.csiro.au

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31 August 2018

The Hon Karen Andrews MP
Minister for Industry, Science and Technology
Parliament House
CANBERRA ACT 2600

We have pleasure in submitting to you, for presentation to Parliament, the seventieth Annual Report of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the year ending 30 June 2018. This report has been prepared in accordance with the requirements of the *Science and Industry Research Act 1949* and in accordance with section 46 of the *Public Governance, Performance and Accountability Act 2013* and the *Public Governance, Performance and Accountability Rule 2014*.

The report was endorsed for presentation to you at the meeting of the CSIRO Board members on 31 August 2018.

The report includes at Part 6 the report from the Chief Executive of CSIRO, as trustee of the Science and Industry Endowment Fund (the Fund), established under the *Science and Industry Endowment Act 1926*, on the operations of the Fund together with 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 annual reporting period, CSIRO restructured its Executive Team to more directly connect to our people and our science by establishing the Executive Director People and Executive Director Growth roles. Data61's CEO joined the Executive Team to build on CSIRO's unique 'digital plus industry' expertise.

We commend the organisation's achievements to you.

Mr David Thodey AO
Chairman of the CSIRO Board

Dr Larry Marshall
Chief Executive of the CSIRO

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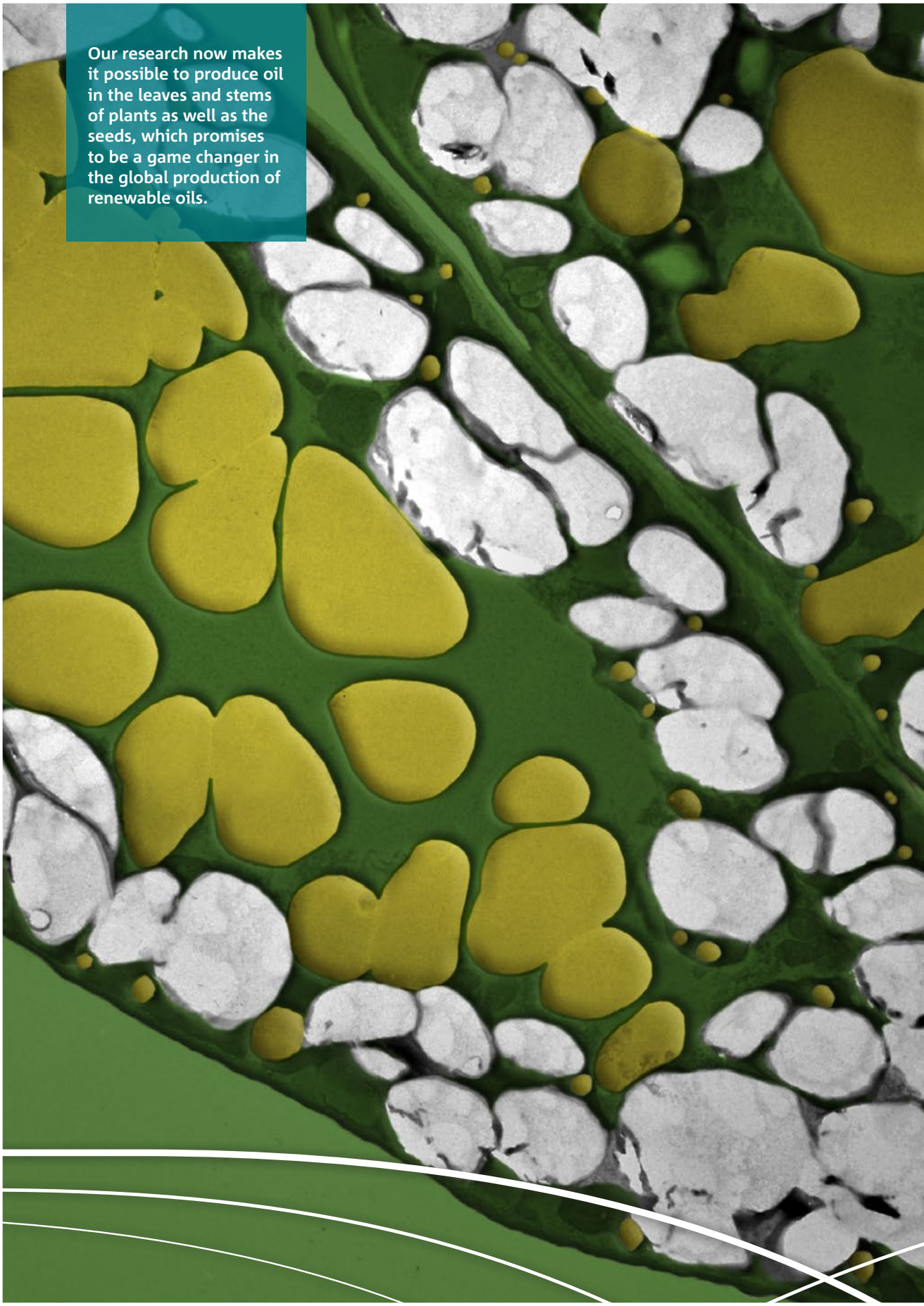

Our research now makes it possible to produce oil in the leaves and stems of plants as well as the seeds, which promises to be a game changer in the global production of renewable oils.

Part 1
Overview

Foreword by the Chairman

This year I have again been proud to see the many achievements of our talented scientists, the diversity of our science and to observe the passion and commitment of our people right across the organisation. It is an honour to be a part of Australia's national science agency as we focus on scientific excellence that creates value for our nation, and helps to lift our national innovation performance.

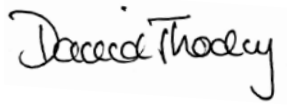
CSIRO is unique in the world because it is one of the few publicly-funded research organisations that focuses on every aspect of science, engineering and technology. This enables the organisation to bring multidisciplinary skills to solve national challenges and create new opportunities. CSIRO is a national asset that belongs to every Australian.

This year has once again seen the organisation deliver leading-edge research, science, solutions and innovations. Our people are delivering solutions through world-class work in agriculture, to monitoring our oceans and atmosphere, to managing our precious water, resources and land, to working across our resources sector, to driving analysis of our energy ecosystem both distribution and generation, and many more detailed in this report. These solutions include some exciting initiatives like a world-first membrane for fuelling hydrogen vehicles, a unique recipe for Australia's first home-grown carbon fibre, a super-charged water filtration technology made from graphene, and an innovative digital platform for connecting remote communities with health specialists in cities. We are also seeing digital technology impact every part of our science and research. Australia's leading digital research network, Data61, is now an integral part of the wider CSIRO team and brings deep technology skills to the work we do with industry and the government.

Our strategy sets out an ambitious plan to support Australia's innovation and science agenda as well as creating a connected innovation system throughout Australia. The Board has been encouraged to see the growing collaboration across the key members of this wider community – recognising that there is still much to do. We have also been encouraged to see two of our key initiatives gain traction – our accelerator ON and the CSIRO Innovation Fund, managed by Main Sequence Ventures – and are delivering national benefit. These two programs have expanded the critical role CSIRO plays in the national – and international – innovation ecosystem, supporting research to transition off the lab bench and into the world though more diverse paths. Investing in early stage concepts through an accelerator, or early stage business models through venture capital, provide opportunities for us to support early stage companies in an increasingly global and diversified marketplace.

The Board and I have had the privilege of meeting many of our teams this year as the Board has had their meetings in Sydney, Geelong, Canberra, Adelaide and Brisbane. CSIRO's people are the reason we are celebrating another successful year. The Board has been encouraged to see the expansion of the Science in Australia Gender Equity (SAGE) program, which was announced last year, and of the inaugural HS-Me Day, held across CSIRO to focus the entire organisation on health, wellbeing and safety.

This annual report describes an organisation which is experiencing positive growth and delivering value to its many customers and partners. Thank you to the entire team at CSIRO for your hard work, dedication and untiring commitment to the mission of our organisation. We have made good progress in the last twelve months and on behalf of the Board, we are looking forward to working with you as we guide CSIRO into its second century together.



David Thodey AO
Chairman of the CSIRO Board

Chief Executive's report

When I was a student at CSIRO in 1984, I marveled at the profound impact our national science agency had on my country and on me personally, by using science to solve Australia's greatest challenges. I'm proud to say that this year when I asked a student at our Lindfield site what it was like to intern at CSIRO, he echoed exactly the feeling I had back then. CSIRO is fueled by the passion and commitment of 5,500 great people who get up each and every day to make life better for all Australians.

When I graduated in 1988, I had to go to overseas to turn my research into innovation, but today CSIRO is different. We've grown our student and post-doctorate population by 30 per cent in recent years, and in 2018, CSIRO ranked #1 Employer of Choice by science and engineering graduates, and #4 overall. Today's students have access to the national science accelerator ON, the CSIRO Innovation Fund managed by Main Sequence Ventures, and they can work in CSIRO's very own collaboration hubs alongside 2,500 customers – companies that will likely employ them when they graduate.

Last year, we delivered science programs to more than 150,000 primary and secondary school students, shining a light on the importance of Science, Technology, Engineering and Mathematics (STEM) subjects and careers. Importantly, we give them real life examples of science paving the way to jobs and industries of the future. The 18 high school student finalists in our BHP STEM awards are leading the way, with 11 of them taking prizes at the Intel National School Science awards in the United States. CSIRO supports these students on their journey of discovery, and in turn, they are an inspiration to us all and our mission to secure Australia's future prosperity through science and innovation.

CSIRO's strategy to be Australia's innovation catalyst has set new benchmarks, including our highest industry revenue, highest global revenue, and breaking into Reuters' ranking of top 25 innovation organisations, which lifts Australia to the third most innovative country on their list. We have also been ranked by the Institute of Electrical and Electronics Engineers as the world's #1 national science agency – both are lists we've never been on before this strategy period. This is our third year of modest growth in people, which is a trend we haven't seen for a decade. Our active licenses are up 25 per cent, indicating the increased relevance of our research, and our royalty revenue has grown by 35 per cent.

All this growth has enabled us to increase investment in blue sky science through our Future Science Platforms, totaling more than $100 million since the start of this strategy period in 2015, and will total $200 million or more by 2020. Our Future Science Platforms plant seeds for our future in renewable energy, sustainable environment, and creating new industries of the future which will deliver the jobs of the future that all Australians need. Our cutting-edge research is underpinned by world-class science, in evidence through our consistent ranking in the top one per cent globally by total citation count. Further, fifty-two per cent of our publications are in the four fields for which we are most strongly ranked for citations, a position we have held for 13 years – as long as CSIRO has tracked this performance.

We can never lose sight of the 'I' in CSIRO – our industry partnerships give our science purpose. We published five industry roadmaps using science to navigate paths to prosperity for Australia's greatest industries. We worked with companies large and small, from 49 of the global Fortune 500, to Small and Medium Enterprises (SMEs), to housing 50 startups in our innovation hubs across the country. This year our SME Connect program facilitated 200 projects – 50 more than in 2017. We were also awarded Boeing Technology Supplier of the Year 2018, for the second consecutive year – again, lifting Australia's profile alongside some of the best innovation organisations in the world.

All these metrics are great, but our people are our greatest asset, and we're committed to strengthening a culture that enables them to do their best work in partnership with our customers. Diversity is the compass to navigate innovation, and this year we continued to implement our SAGE Action Plan. Over the strategy period, we've increased gender diversity at the fastest rate ever, and this year we entered the SAGE 'green zone' (≥41 per cent women) for the first time ever, and women in leadership have increased by 50 per cent in science management roles. Nearly 25 per cent of CSIRO people have a non-English speaking background, and we have doubled our Aboriginal and Torres Strait Islander population. Making safety personal enables us to take greater innovation risk without personal risk, so this year we held our first 'HS-Me Day' to focus on safety. So far over the strategy period we've reduced our MTIFR (Medical Treatment Injury Frequency Rate) by 38 per cent and our RIFR (Recordable Injury Frequency Rate) by >20 per cent. We will never be complacent about safety; it's our people who give our science and strategy purpose.

Reflecting on the incredible work showcased in this annual report – and outside its pages – it's great to know that our children will grow up in an innovation era where their national science agency is empowering them to create a better future for all Australians.

Dr Larry Marshall
Chief Executive of the CSIRO

About us

We are Australia's national science agency, solving our greatest challenges through innovative science and technology.

Uniquely positioned to tackle such challenges, CSIRO is home to over 5,500 of the world's brightest minds networked across a comprehensive research portfolio. We collaborate closely with industry, government and the extended research community to drive innovation that leaves a lasting legacy for our nation. Our research improves the health and wellbeing of our communities; transforms our industries to successfully compete in a global marketplace; and accelerates international understanding of our diverse natural environments to sustain them for generations to come.

Our world-class research is bolstered by state-of-the-art national research facilities and collections, shared by the whole national innovation system and international researchers, and increasingly by the public. This specialist technology and infrastructure allows us to explore the furthest reaches of the universe and the unimaginable depths of the oceans. Our expansive biological collections provide critical data for global biodiversity knowledge.

We are not only tackling today's challenges but preparing for tomorrow. We partner with schools and universities to grow our national pipeline of science, technology, engineering and mathematics professionals. By strengthening our talent pipeline, we are securing our future as a global force in tackling our greatest challenges.

Preparing for our greatest challenges

Our mission-directed research and development provide solutions to our greatest challenges through Business Units focused on eight core areas of research. We also prepare for our nation's unfolding needs, generating insights and identifying opportunities, through our eight Future Science Platforms.

We manage Australia's state-of-the-art infrastructure and biological collections on behalf of the nation. And our services develop national science talent through education, engage Australia's critical community of small and medium enterprises, and produce science and technology publications through CSIRO Publishing.

MISSION-DIRECTED RESEARCH AND DEVELOPMENT

Agriculture and Food
Improving productivity, profitability and sustainability

Data61
Solving Australia's largest data-driven challenges

Energy
Delivering a low emissions energy future

Health and Biosecurity
Understanding human, animal and environmental health and biosecurity

Land and Water
Addressing environmental, and land and water management challenges

Manufacturing
Innovative industry-driven manufacturing solutions

Mineral Resources
Mineral resource discovery and efficient development

Oceans and Atmosphere
Safeguarding our marine and atmospheric environments

Future Science Platforms

Active Integrated Matter
Creating Industry 5.0

Deep Earth Imaging
Unlocking our resource potential

Digiscape
Digital solutions for the land

Environomics
Environmental genomics to care for biodiversity

Hydrogen Energy Systems
Next generation energy industry

Precision Health
Integrated and tailored health solutions

Probing Biosystems
Innovative medical devices and diagnostic technologies

Synthetic Biology
Artificial engineering of biological systems

MANAGING NATIONAL RESEARCH INFRASTRUCTURE

Digital National Facilities and Collections

Astronomy and Space Science
Understanding the universe

Australian Animal Health Laboratory
Protecting Australia

National Research Collections Australia
Securing our biodiversity future

Marine National Facility
Supporting, enabling and inspiring marine science

National computing infrastructure
High performance innovation

DEVELOPING NATIONAL SCIENCE TALENT

CSIRO Services
Education, SME Engagement, Infrastructure Technologies, Publishing and Futures

Enterprise Support Services
Professional, relevant advice and assistance

Our strategy accelerates innovation

Under our strategy we've made tremendous progress against all our key performance indicators, showing Australia's national science agency is solving our greatest challenges through innovative science and technology. Our success has been driven by a focus on the strategic pillars underpinning our role as Australia's innovation catalyst.

External reviews of the impact of our research continued to exceed benchmarks, including finding that just 21 projects alone have a present value estimated at $1.28 billion. Our impact is underpinned by our commitment to science excellence, demonstrated by our citation rate maintaining its prestigious place in the top quartile of Australian universities, and above the global average. Further, our investment in the areas of breakthrough research that will deliver tomorrow's high impact results is on track, growing our Future Science Platforms by two, and almost doubling the number of propositions supported by the CSIRO Innovation Fund, managed by Main Sequence Ventures, compared with our target number.

Everything we do is delivered through collaboration, so our partner metrics are equally as important. This year we exceeded our satisfaction targets for universities involved in the ON program, and increased our customer Net Promoter Score from last year, more than doubling our target. We continued to ensure the impact of the Science and Industry Endowment Fund (SIEF) was spread around the national research system with 93 per cent of projects involving more than one organisation, and we championed the profile of science in the community by increasing participation in our outreach programs by 10 per cent, well above our target of 5 per cent.

Our management of national research infrastructure on behalf of the broader scientific community saw us meet or exceed all our targets for maintaining world-class standards and enabling high levels of utilisation throughout the Australian research sector.

Our people are our most valuable asset, and this year we exceeded all our targets as we continue strengthening CSIRO's culture and enabling our people to do their best work for the nation. Our strategy delivered gains in gender diversity in leadership, increasing engagement scores, internal and external reputation growth, high safety and wellbeing standards and a well-managed budget. Each of these factors ensures CSIRO can continue to attract and retain the best talent in the world.

This annual report tells a clear and compelling story of the real difference CSIRO is making in Australia and the world. While delivering against our key performance indicators, here are a few of our highlights arranged by strategic pillar.

CUSTOMER FIRST

Boeing Supplier of the Year award
for second consecutive year

Top Engineering, R&D and Manufacturing Graduate Employer
awarded by GradAustralia

2,400 customers
including 1000 SMEs, 488 international customers, 311 government departments and 355 large corporates

49 US Fortune 500
customers

Increased customer satisfaction
+40 up from +34 last year

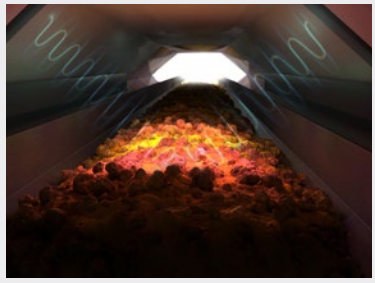
BREAKTHROUGH INNOVATION

Eureka Prize for Innovation in Medical Research
awarded to Colvera, a new blood test for bowel cancer

Ranked 18
in the Reuters Top 25 Global Innovators – Government list, and the only Australian institution

222 teams
through our ON accelerator program since 2015

25% increase
in projects connecting SMEs with research, injecting $25m into R&D



10% increase
in revenue from international sources since 2013–14

EXCELLENT SCIENCE

- We have **invested >$100 million in basic strategic science** in the last 3 years.
- **Coviu**, an **online health services platform** used by about 1,100 healthcare professionals, has enabled more than 20,000 video consultations since 2015. Coviu developed out of our ON program and has **secured a $1 million investment** from the CSIRO Innovation Fund, managed by Main Sequence Ventures.
- We announced a **new Earth Observation Centre**, which **will collect and analyse data about Earth** from space. The centre signed its first agreements, including with CSIRO's partner, Geoscience Australia, for the Digital Earth Australia program.

COLLABORATION HUB

- Through the government-supported Australian Future Fibre Research and Innovation Centre, we collaborated with Deakin University to **develop technologies that will produce high-quality, low-energy carbon fibre** at low cost. This will allow the technology to be broadly adopted across a range of industries.
- Using our national infrastructure in Western Australia, **US collaborators detected a signal from the first stars** to have emerged in the early universe about 180 million years after the moment of creation. CSIRO's national facility in Murchison, Western Australia, is one of the most 'radio-quiet' sites on earth and has been selected as the site for SKA-LOW.

DELIVER ON COMMITMENTS

- Revenue from **intellectual property increased by 35%** in the last year.
- We **opened the landmark $100 million collaborative research facility Synergy** at the Black Mountain Science Innovation Precinct. The building provides new research capability combining the power of Data61, Land and Water, and Oceans and Atmosphere working on areas such as future crops, natural resources, climate science, and digital solutions.

INCLUSION, TRUST AND RESPECT

- We expanded our participation in two key government-funded, National Innovation Statement initiatives: the **SAGE program**, initiated by the Australian Academy of Science, and **Male Champions of Change** STEM, established in late 2016.
- The number of **Aboriginal and Torres Strait Islander staff employed at CSIRO increased** from 58 in 2015–16 to 115 in 2017–18. 2% of our employees identify as Aboriginal or Torres Strait Islander.

HEALTH, SAFETY AND ENVIRONMENT

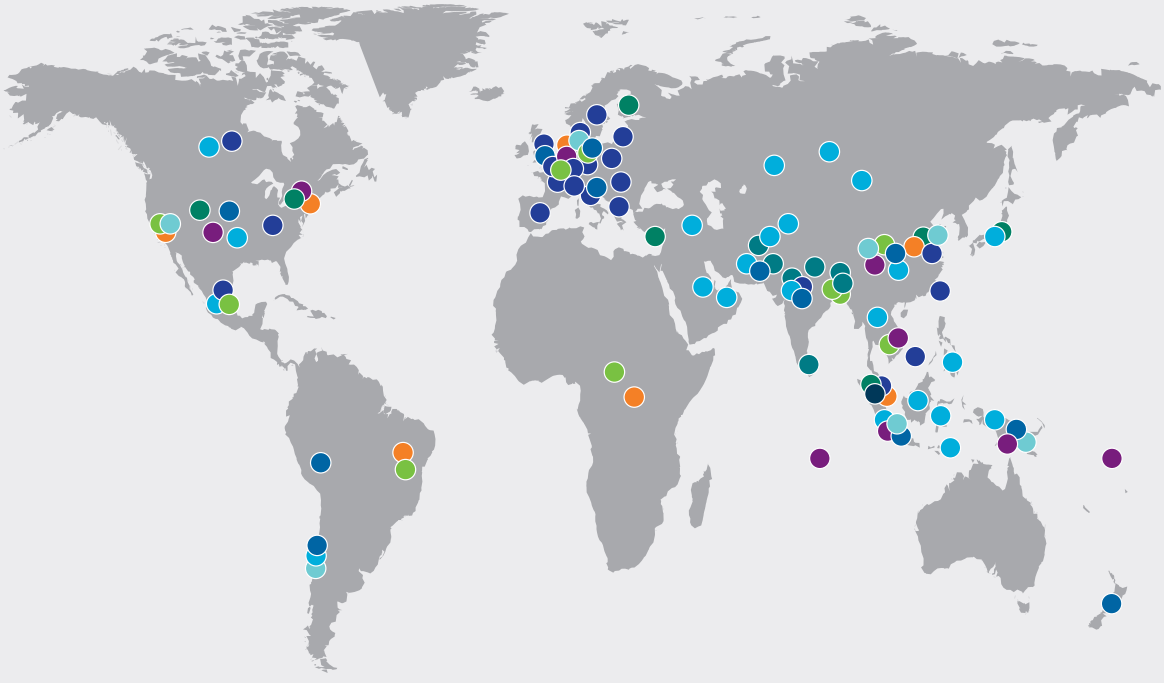
- Our **Recordable Injury Frequency Rate has dropped** by 45% since 2015 and we had the fewest notifiable incidents in 5 years.
- CSIRO's **carbon emissions from electricity and gas consumption dropped by 5%** compared to the previous year and 11% over the last 5 years. CSIRO's electricity-and gas-related emissions are 7% below the 5-year average. Electricity-related emissions fell by 6% in 2017–18.

GLOBAL OUTLOOK, NATIONAL BENEFIT

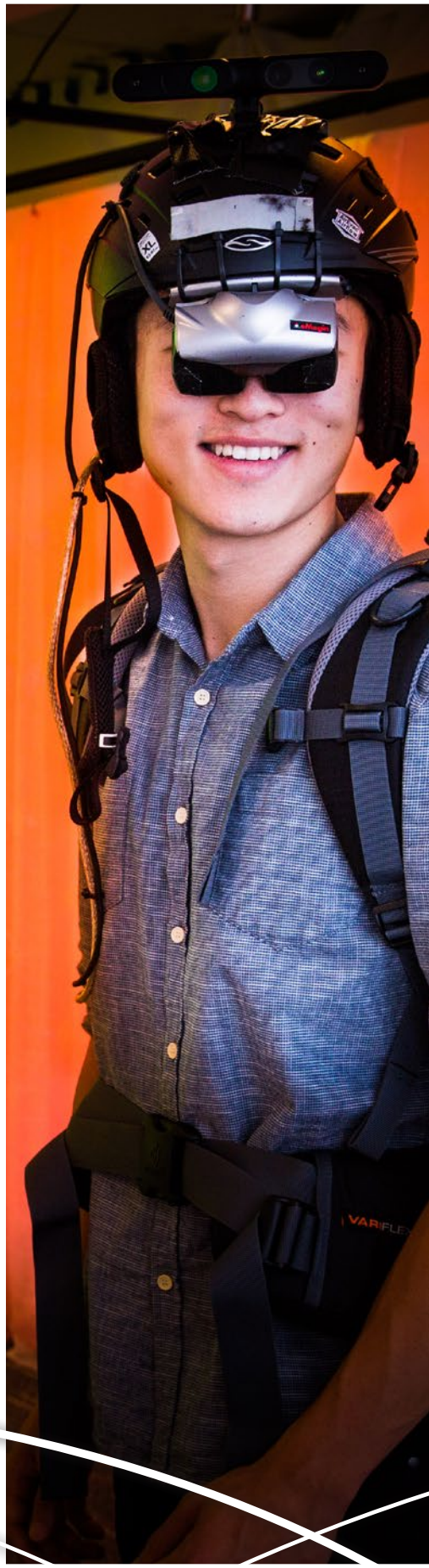
- CSIRO helped to secure export access to the European Union by proving the environmental credentials of the **Australian canola industry**. A $1.8 billion market for our Australian farmers.
- We partnered with non-profit organisation Radiant.Earth to **improve international disaster resilience responses**, with a special focus on the Asia-Pacific region, using satellite technology and Earth observation data capabilities.
- We collaborated with the US Government's Defense Advanced Research Projects Agency to trial our **sel4** microkernel technology that **maintains systems security while providing access to multiple isolated networks**. The technology received a national award for research and development at the iAwards in September 2017.

GLOBAL PROJECTS BY AREAS OF BUSINESS

- Agriculture and Food
- Energy
- Health and Biosecurity
- Land and Water
- Manufacturing
- Mineral Resources
- Oceans and Atmosphere
- Digital National Facilities and Collections
- Services



Our extraordinary people are critical to CSIRO's success and bring our excellent science to life.



Part 2
Our people

At CSIRO, we solve Australia's greatest challenges with science. These are complex problems and solving them will make a real difference to the future of Australia and the planet. To do so, our people work with some of the most talented minds in their fields, not just in Australia, but in the world. We spark off each other, trust each other and collaborate closely to achieve more than we could individually. We strive to attract the best people and develop and engage them in an inclusive and diverse environment.

As at 30 June 2018, we had 5,767 staff, a full time equivalent of 5,190. Of these, 3,648 or 63 per cent, were classified within the research function.

The number of staff increased by 202 this year

Overall, the number of staff increased by 3.6 per cent (202) this year. Research science staff increased by 3.9 per cent (60). Voluntary staff turnover remained relatively low at 5.4 per cent. The proportion of female staff increased by 1 per cent to 41 per cent and the proportion of female research science staff remained constant at 27 per cent.

On 1 July 2014, CSIRO implemented a new operating model. Under this model, we classified a broader range of leadership appointments as Research Managers. This led to an increase in the number of staff reported in this classification from that date. In 2016–17, the creation of Data61 led to the classification of new roles in General Management and changes in some functions led to an increase in staff reported in that functional area.

TABLE 2.1: STAFF NUMBERS (HEADCOUNT)

FUNCTIONAL AREA	2013–14	2014–15	2015–16	2016–17	% FEMALE 2016–17	2017–18	% FEMALE 2017–18
Research							
Research Scientists/Engineers	1,798	1,520	1,466	1,473	27	1,533	27
Research Project staff	1,874	1,669	1,752	1,803	41	1,809	42
Research Management	181	254	248	246	19	251	22
Research Consulting	47	40	54	58	22	55	26
Non-research							
Senior Specialists	17	21	20	21	43	19	42
Technical Services	569	537	586	621	16	672	17
Communication and Information Services	326	201	203	237	78	260	78
General Services	34	16	23	20	55	19	53
Administrative Support	980	908	909	942	75	999	75
General Management	138	103	106	144	40	150	45
Total headcount	**5,964**	**5,269**	**5,367**	**5,565**	**40**	**5,767**	**41**
FTE	**5,423**	**4,836**	**4,864**	**4,990**	**38**	**5,190**	**39**

Our people strategy

Our extraordinary people are critical to CSIRO's success and bring our excellent science to life. We are committed to fostering individual growth and providing equal opportunities for our people.

Our People Strategy is underpinned by the Cultural Alignment Program. Its key attributes are a culture of mutual trust, transparency and accountability, collaboration, and inclusion and participation.

The four focus areas of our strategy are:

734 staff attended CSIRO Connect events across Australia

Empower

Our leaders and staff are empowered to deliver our strategy. This year, we facilitated staff to more fully engage and take part in organisational decisions and change. We created explicit opportunities for staff to engage and collaborate across the organisation through CSIRO Connect employee events, round-table discussions, Leader Change webinars and crowd sourcing of ideas and challenges.

This year, 734 staff attended CSIRO Connect events across Australia. The Taking Action program has been initiated to begin addressing significant enterprise challenges identified by staff during the events. With an open invitation to contribute ideas and solutions, staff participating in CSIRO Connect 2018 have the opportunity to work directly on challenges during the events. It is expected that more than 2,000 staff will participate in CSIRO Connect 2018.

Talent

We support our staff to innovate to meet the needs of our customers and actively recruit staff who will contribute to our innovation agenda. CSIRO is developing a new approach to assessing and filling its future workforce and has established a student and early-career staff focus to deepen partner relationships with universities, increase engagement in education and training from school-age to PhD level, and help build Australia's future science, technology, engineering and mathematics (STEM) and innovation-capable workforce. See pages 49-50 for details on our student programs.

This year, we also began work on our Employee Value Proposition to differentiate CSIRO as an employer of choice, improve our employee experience to retain and develop critical science capability, and attract new people to world-class science, engineering and digital research for Australia's future. We will fully define and develop this proposition over the coming year.

We also delivered new learning and development initiatives to support our diverse people and teams. These initiatives will enable our staff to work together more effectively to solve complex problems and build critical skills, which will support our role as a catalyst in the innovation system.

We successfully piloted the Productive Collaborations program and delivered the Executive 360 Feedback and Coaching Program for the Executive and CSIRO Leadership teams. Over 280 coaching hours were provided during 2017–18. For details on our learning and development programs, see page 52.

Our students 2017–18

>150,000 primary and secondary school students in our science education programs

>2,000 undergraduate and postgraduate students

>380 Postdoctoral Fellows

Mobility and agility

In early 2018, CSIRO launched an organisation-wide secondment and mobility program called Switch to increase our contribution to the exchange of people and know-how between research, industry and government. It means we can bring our best people to where they are needed the most, quickly. The introductory phase, now underway, offers 25 placements open to all staff.

Diversity and inclusion

We aim to make our teams more diverse and inclusive by attracting people from across society and creating an environment where each individual is included and supported to realise their full potential. Through a workplace culture that accepts, values and enables difference, we are committed to building an inclusive culture of equitable opportunity, where you can bring your whole self to work.

In 2017–18, our diversity and inclusion initiatives included:

- Launching the Balance flexible workplace initiative on 1 July
- Submitting the CSIRO Science in Australia Gender Equity (SAGE) Plan Application, and Plan for the Athena Scientific Women's Academic Network (SWAN) Bronze Award
- Increasing leader engagement through the SAGE program, all state roadshows and focus groups
- Making the Chief Executive Panel Pledge to ensure equal gender representation on panels
- Delivering a Gender Pay Gap analysis in collaboration with CSIRO's Data61
- Establishing Business Unit diversity and inclusion plans, aligned to our strategy
- Delivering the Inclusive Leader pilot program in Agriculture and Food, to be rolled out across Business Units in 2018–19
- Further integrating diversity and inclusion content into the CSIRO leadership development curriculum
- Launching the new Pride@CSIRO network strategy.

For details on our diversity and inclusion programs, see pages 73-74.

Advances in Indigenous engagement

Aboriginal and Torres Strait Islander peoples have made and will continue to make extraordinary contributions to Australia across cultural, economic and scientific domains. We recognise the social and economic disadvantages they have experienced and are committed to overcoming the gap between Aboriginal and Torres Strait Islander peoples and non-Indigenous Australians.

We engage and partner with Indigenous peoples across several areas, such as marine and environmental science, human resources, property services, astronomy and space science, information management and technology, mining, horticulture and aquaculture. In this way, they are contributing to research affecting the productivity and sustainability of Australian industry. Aboriginal and Torres Strait Islander peoples are also represented on various advisory committees such as the Indigenous Strategic Advisory Council, Health and Biosecurity Advisory Committee and Indigenous STEM Education Project Steering Committee.

We are partnering with the BHP Billiton Foundation to implement a five-year $28.8 million education project, which is supporting more Aboriginal and Torres Strait Islander students to take part in and achieve in STEM. This year, we announced the second round of Indigenous STEM Awards winners and finalists and offered cadetships to several students who had previously taken part in the ASSETS (summer camp) program.

Six programs cater to the diversity of Aboriginal and Torres Strait Islander students as they progress through primary, secondary and tertiary education, and into employment:

- **Science Pathways for Indigenous Communities** targets primary and middle school students in remote Indigenous communities and uses on-country projects as the context for learning science linked to Indigenous ecological knowledge.
- **Inquiry for Indigenous Science Students** targets middle-school students in mainstream metropolitan and regional schools, using hands-on inquiry-based projects to increase student engagement and achievement in science.

- **PRIME Futures** targets Foundation to Year 9 students in mainstream metropolitan and regional schools and uses the YuMi Deadly Maths approach to improve student outcomes in mathematics.
- The **Aboriginal Summer School for Excellence in Technology and Science** (ASSETS) is a nine-day residential program for high-achieving Indigenous Year 10 students with an ongoing leadership and support program to nurture students through Years 11 and 12 (see page 53 for further details).
- The **Indigenous STEM Awards** rewards Indigenous students, teachers, schools and scientists as well as STEM champions who have supported Aboriginal and Torres Strait Islander peoples' achievements in STEM.
- The **Bachelor of Science** (Extended) is a degree program that provides a supported pathway to complete a mainstream Bachelor of Science at the University of Melbourne. It is designed for Aboriginal and Torres Strait Islander students who show potential, but who might otherwise not have access to such an opportunity.

Employment strategy

In March 2015, the Australian Government announced a target of 3 per cent Aboriginal and Torres Strait Islander representation in the Commonwealth public sector by 31 December 2018 and assigned CSIRO a target of 2.5 per cent representation. In our Reconciliation Action Plan (RAP), we committed to a 3 per cent representation target and have moved towards the target from 58 Aboriginal and Torres Strait Islander staff (1.2 per cent) in August 2015. As at 30 June 2018, 115 (2 per cent) of our employees identified as Aboriginal or Torres Strait Islander. Of these, 21 were cadets, 17 were trainees and 77 were research, technical, administrative and management staff.

In January, we finalised the review of our Aboriginal and Torres Strait Islander Employment Strategy and identified activities in the recruitment, development, promotion and retention of Aboriginal and Torres Strait Islander staff. An Indigenous Capability Advisor has been appointed for 12 months to help implement this strategy. For details on our Indigenous engagement, see page 74.

115 of our employees identified as Aboriginal and Torres Strait Islander

Our commitment to health and safety

CSIRO is committed to the safety and wellbeing of our people and has embraced a learning culture to continually improve how we manage safety and wellbeing.

This year, we launched a safety cultural change program to improve personal ownership of safety. HS-Me Day was held on 16 May across all our sites globally – at home, in the field, laboratory or office. Activities fell into three streams: conversations about how to ensure our future safety; practical clean up or hands-on safety management activities; and 'flourishing communities and individuals', which focused on mental health and wellbeing. All sites recorded good uptake of the concept and reported positively on the way people were encouraged to make health and safety their own responsibility.

Our site-based hands-on safety management activities aimed to empower site leaders, teams and individuals to tailor programs to be relevant for each site and to highlight organisational initiatives that could make all staff safer in the future.

For the Lindfield site this meant:

> *'supporting lab custodians in their roles. We used it to boost the visibility and importance of the role and gave lab custodians permission to direct their teams in lab-based activity they thought were a priority.'*

Our Site Leader at the Queensland Centre for Advanced Technologies said that:

> *'based on feedback from staff, the HS-Me Day was … relevant, unifying and motivating.'*

Other sites undertook marine safety demonstrations, gas line checks, fire extinguisher training, electronic waste clear outs, workstation ergonomic assessments, first aid training, legacy chemical disposals and much more, with hundreds of safety initiatives completed on the day.

Overall, 73 per cent of respondents indicated that participating in HS-Me Day activities improved their awareness of their personal responsibility for HSE. Furthermore, 80 per cent of respondents would recommend this format of events again to help focus attention on health and safety. The results indicate that the day was engaging and spoke to the importance of our staff wellbeing.

Two strong themes emerged: the importance of social interactions and building caring communities at work, and empowering individuals to access timely and relevant support, especially mental health resources. These themes will inform our future HSE work. For details on our HSE performance, see page 76-83.

On HS-Me Day, Brett Roddy from Services demonstrates how a piece of equipment in North Ryde's fire testing facility works.

Celebrating the achievements of our people

ORDER OF AUSTRALIA

Companion of the Order (AC)

Professor Trevor John McDougall (CSIRO Honorary Fellow) for eminent service to science and education, particularly in the area of ocean thermodynamics, as an academic and researcher to furthering the understanding of climate science and as a mentor of young scientists.

Professor Ezio Rizzardo (CSIRO Fellow) for eminent service to scientific technological research and development in the field of polymer chemistry, to its application in the biomedical, electronics and nanotechnology context, as an author and through mentorship roles.

Member in the General Division of the Order (AM)

Dr Robin Anthony Bedding (CSIRO Honorary Fellow) for significant service to science in the field of entomology as a researcher, and to the forestry industry both nationally and internationally.

AUSTRALIAN MUSEUM EUREKA PRIZES

The Colvera Team: CSIRO, Clinical Genomics Pty Ltd and Flinders University won the 2017 Johnson & Johnson Eureka prize for Innovation in Medical Research. The team developed a clinically validated blood test that sensitively and accurately detects cancer DNA in the blood plasma of colorectal cancer patients. This will enable oncologists to improve treatment by detecting disease earlier, which may help more patients to survive.

FARRER MEMORIAL MEDAL AND GRAINS RESEARCH AND DEVELOPMENT CORPORATION RECOGNISING AND REWARDING EXCELLENCE AWARD

Dr John Kirkegaard was awarded the 2017 Farrer Memorial Medal for his work in understanding soil-plant interactions to make dryland farming systems more productive, efficient and sustainable. He also received an award of excellence from the Grains Research and Development Corporation recognising his outstanding ability to develop practical and effective crop management practices.

WEB OF SCIENCE HIGHLY CITED RESEARCHERS 2017

Dr Alan Richardson, Dr Kemal Kazan, Dr John Manners, Dr Elizabeth Fulton, Dr Pep Canadell and Dr Raphael Viscarra Rossel were named 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 1% by citations for field and publication over an 11-year period.

TELSTRA TASMANIAN BUSINESS WOMAN OF THE YEAR

Toni Moate was named 2017 Telstra Tasmanian Business Woman of the Year and also received the 2017 Telstra Tasmanian Public Sector and Academia Award. She won the awards for successfully leading a $44 million business unit, contributing to national research infrastructure and delivering the marine research vessel *Investigator* build, as well as for her commitment to values-driven communication and empowering others to make a positive impact.

2018 QUEENSLAND WOMEN IN STEM PRIZE

Cécile Godde received the Judge's Choice Award in recognition of her work to incorporate many dimensions in her agricultural research. Her passion for creating a better planet and for gender equity in science were also acknowledged.

ELSEVIER SCOPUS RESEARCHER AWARDS 2017

Dr Michelle Colgrave was awarded runner-up for the Women in Research Award. The award was created to inspire and encourage more female researchers who choose to pursue academic work. It recognises outstanding researchers who have made significant contributions to research in Australia and New Zealand.

BLUE PLANET PRIZE

Professor Brian Walker was awarded the 2018 Blue Planet Prize for outstanding achievements in scientific research and its application in solving global environmental problems. He has pioneered 'resilience science' in social-ecological systems.

SOIL SCIENCE AUSTRALIA PRESCOTT MEDAL

Dr Neil McKenzie was awarded the J.A. Prescott Medal for outstanding contributions to soil science.

CSIRO CHAIRMAN'S MEDAL FOR SCIENCE EXCELLENCE

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

The **Cereal rust disease prevention** team were awarded the medal for contributing to global food security by protecting cereal crops against rust diseases. They worked with the Grains Research and Development Corporation on this pioneering research.

CSIRO MEDAL FOR LIFETIME ACHIEVEMENT

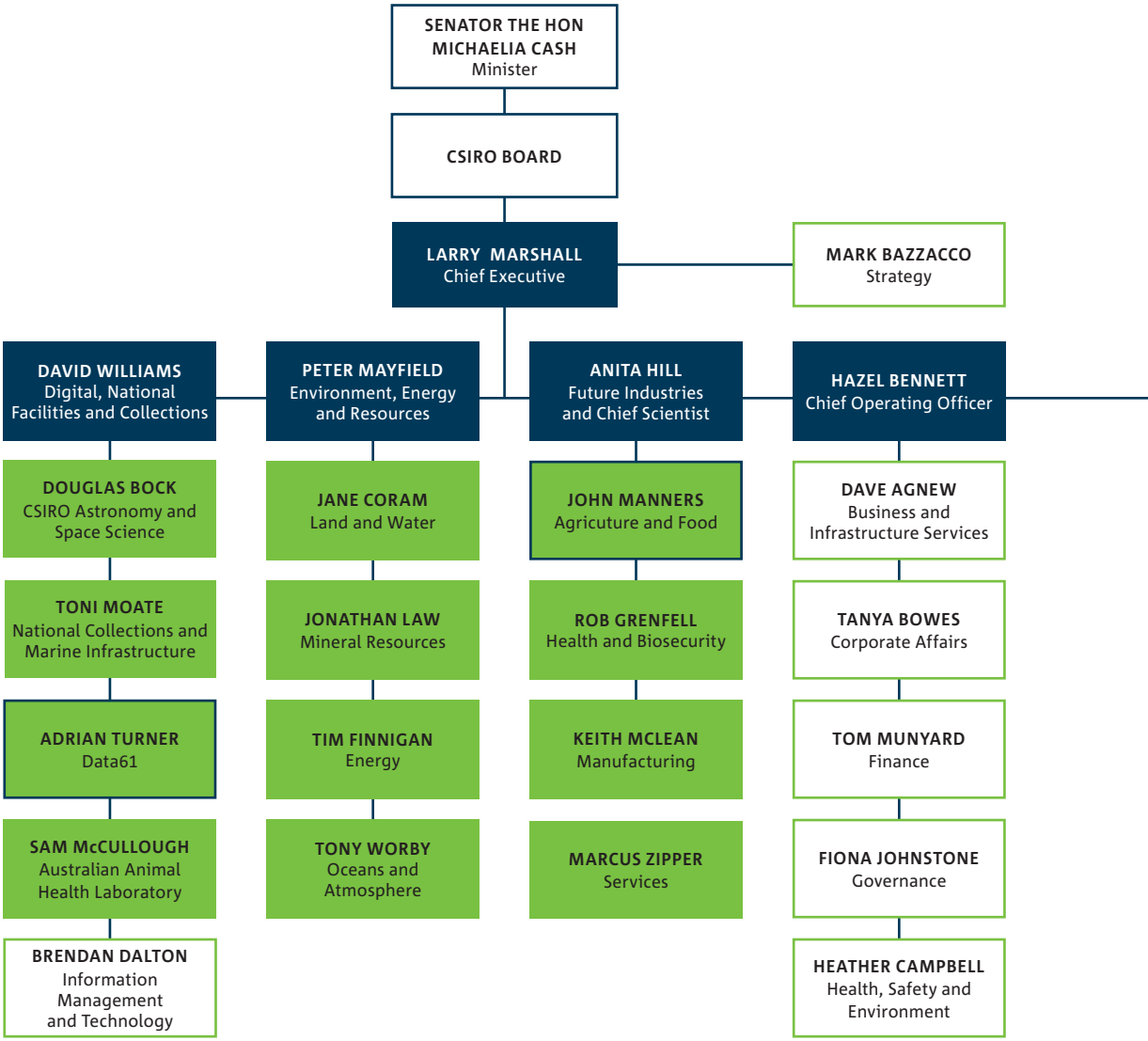
This award recognises individuals who have a record of sustained and meritorious achievements in science, technology and innovation or the support of science, technology and innovation.

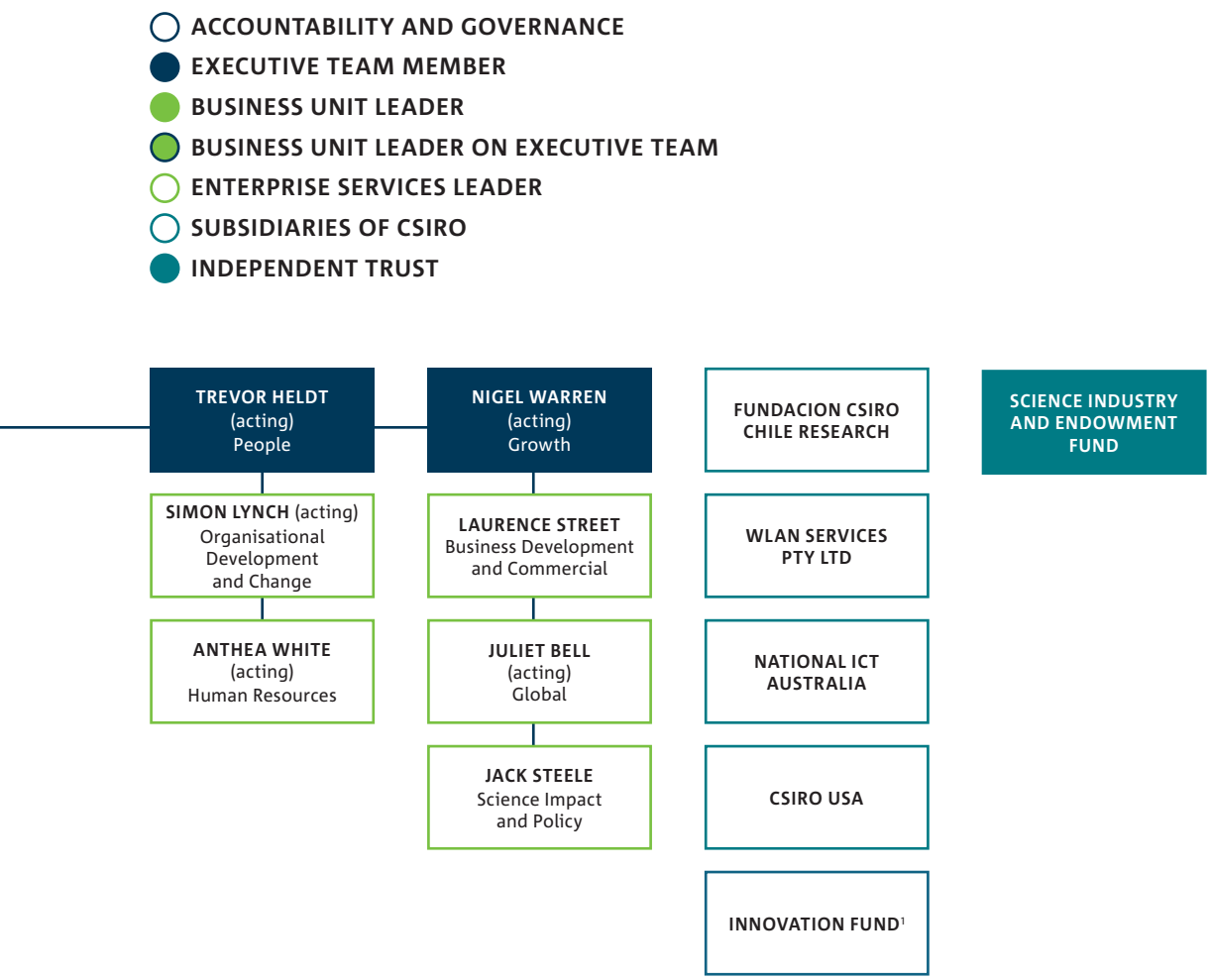
Dr Jennifer Stauber was awarded the medal for her landmark research on the bioavailability and toxicity of contaminants underpinning the development of the national water and sediment quality guidelines for environmental protection in Australasia and globally over 38 years.

Dr Mark Stafford Smith was awarded the medal for over 30 years of international leadership in sustainability science, valued for informing policy and management of human ecosystems under global change and uncertainty, and for supporting our research teams in climate adaptation and sustainable development.

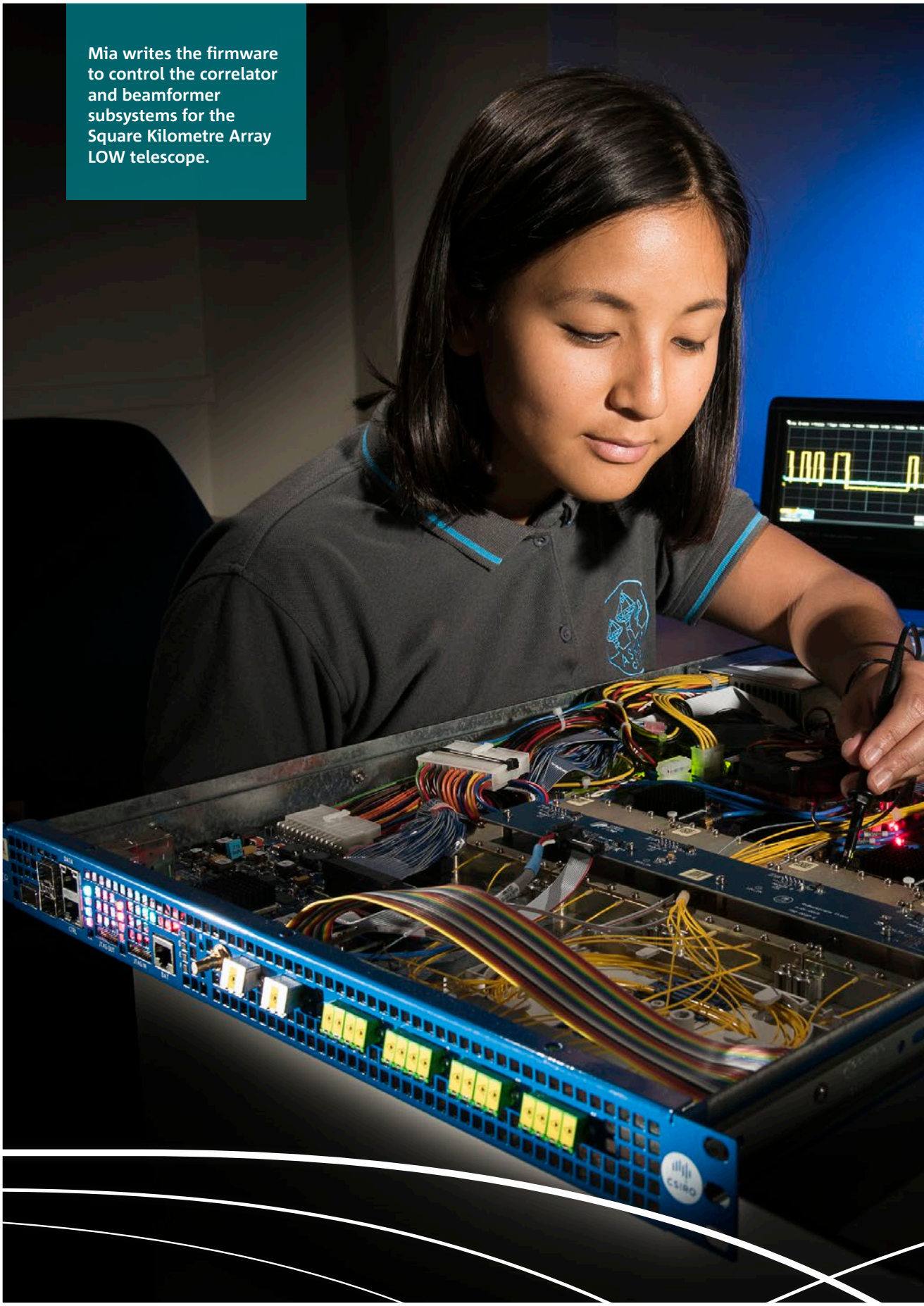
Our organisational structure

AS AT 29 JUNE 2018

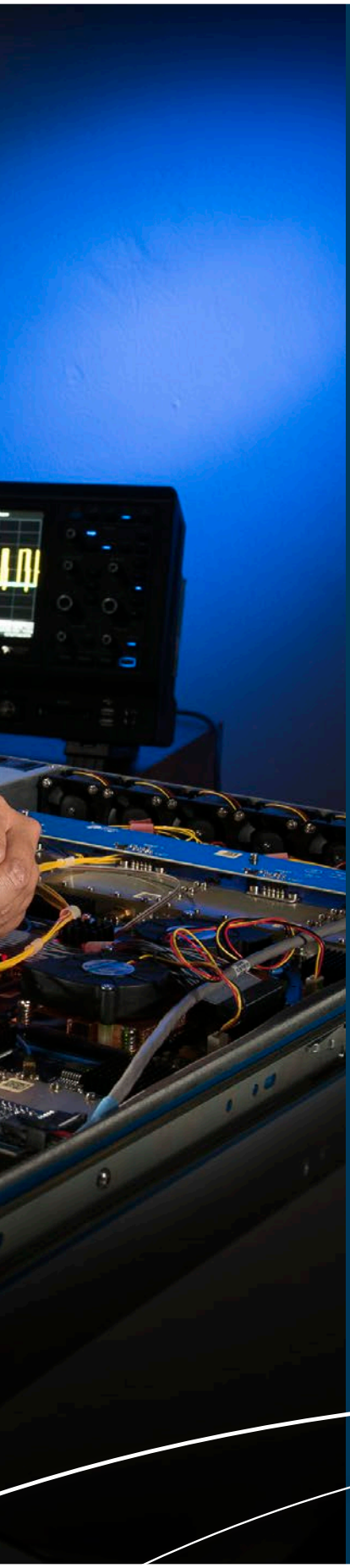




1 Further details on the structure and entities to manage and operate the Fund are on page 128.



Mia writes the firmware to control the correlator and beamformer subsystems for the Square Kilometre Array LOW telescope.



Part 3
Annual performance statement

Introductory statement

We, the CSIRO Board, as the accountable authority of CSIRO, present the 2017–18 annual performance statements as required under s39(1)(a) 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.

Purpose

CSIRO is a Corporate Commonwealth Entity within the Industry and Science Portfolio, operating under the provisions of the *Science and Industry Research Act 1949* (SIR Act). Our purpose is defined through the functions we undertake as set down in the Act and as per our Corporate Plan 2017–18:

Our purpose is to collaboratively address national priorities and assist industry by conducting and encouraging the uptake of world-class scientific research, managing research facilities on behalf of the nation, and mobilising and developing the next generation of scientists for the benefit of Australia.

Results

CSIRO plays an important role in Australia's national innovation system. Consistent with our responsibilities outlined in the SIR Act, we aim to deliver innovative solutions for industry, society and the environment, and to see our science used to make a positive impact for the future of Australia and humanity.

This section of our annual report provides evidence of our performance against the performance expectations set out in our Corporate Plan 2017–18[2] and the Portfolio Budget Statements 2017–18.[3]

The following sections provide a detailed analysis of the results for each performance measure plus additional information to illustrate our achievements this year, organised per core activity.

2 CSIRO's Corporate Plan is available at www.csiro.au/en/About/Strategy-structure/Corporate-plan.
3 CSIRO's Portfolio Budget Statement is available at www.csiro.au/en/About/Our-impact/Reporting-our-impact/Performance-reviews/Portfolio-budget-statement.

Activity 1:

Mission-directed research and development

Coviu, our advanced video telehealth platform, has connected more than 20,000 patients with practitioners in regional and metropolitan areas across Australia.

TABLE 3.1: SUMMARY OF OUR PERFORMANCE FOR ACTIVITY 1

KPI AND METRIC	TARGET	RESULT	
Triple bottom line impacts: • Collection of externally validated case studies • Maintain or increase the assessment on impact criteria from independent Business Unit reviews in the top two rating levels • An external 'Value of CSIRO' impact assessment	Minimum of 6 case studies	G	We completed 36 impact case studies across 5 Business Units and one government and industry research alliance this year.
	Rated 80% either benchmark or strong on the impact criteria	G	Of the Business Units reviewed, the panel rated 89% of the research programs as strong to benchmark on impact delivered to the nation.
	Benefit Cost Ratio = 5:1	G	The benefit cost ratio across 43 impact case studies is 6:1, delivering total annual benefits of over $9 billion per year.
Evidence of outcomes and impacts of SIEF funded projects	Minimum of 1 impact case study	G	One impact case study completed on the Distal Footprints project. The project has developed an innovative approach that could allow resource discovery rates of very deep resources to increase significantly. (See the SIEF report on page 146 for details.)
Science excellence: Maintain or increase normalised citation rate relative to global average performance	Top quartile of Australian universities & >50% global average	G	Citation rate >50% of the global average and CSIRO remained ranked in the top quartile of Australian universities.
Strategic innovation investment: • Direct science investment including future science platforms, capability development and centrally competitive funds • Pipeline of investable propositions from the CSIRO Innovation Fund from the Publicly Funded Research Agencies (PFRA) research institutions	$18m invested in Future Science Platforms	P	$16.7 million invested in Future Science this year. We commenced two new FSPs this year, with a prudent approach to funding the early stages of the FSPs accounting for the shortfall in investment against the target.
	At least 5 investable propositions pursued	G	Nine investments made in deep technology companies from the publicly funded research sector.
University engagement: Feedback from the universities involved in the ON program – maintain or increase their willingness to recommend (4 or higher on 5-point scale)	80% of university participants highly recommend the program	G	93% of university participants highly recommend the ON program, demonstrating its relevance and effectiveness.
Customer and user satisfaction: Customer net promoter score (NPS)	+16	G	The NPS for 2017–18 was +40, which is a solid improvement over the +34 favourable result achieved last year.
Research partnerships: Proportion of Science and Industry Endowment Fund (SIEF) research projects involving more than one organisation	>93% projects involve more than one organisation	G	SIEF has reached its target of 93% of projects involving more than one organisation. Since 2009, SIEF has successfully facilitated collaboration among 105 different organisations (see the SIEF report on page 147-148 for details).

Green shading indicates positive progress for the year and the target has been achieved.
Purple shading indicates some challenges have occurred during the year, but they were managed.

Triple bottom line impacts

To provide the evidence that our work delivers economic, social and environmental impacts, we undertake impact case studies annually[4], Business Unit Reviews every three to four years and 'Value of-CSIRO' impact assessments.

In 2018, ACIL Allen Consulting (ACIL Allen) conducted an assessment of the impact and value delivered to the economy and the innovation system by the public investment in CSIRO.

The present value of benefits from 21 impact case studies totalled 1.28 billion

The report quantified the benefits of 21 impact case studies and assessed their present value at $1.28 billion per year. This result builds on the assessment from 2017, which examined 22 case studies, estimating that CSIRO was delivering more than $3.2 billion per year in benefits to the nation, and a 5:1 return on investment. Combining the 2017 and 2018 results, and adjusting to current-dollar terms, this increases our estimate of the annual value CSIRO delivers to the nation to at least $4.5 billion per year.

Furthermore, ACIL Allen concluded in their 2017 assessment that it is reasonable to assume that the annual value delivered by all other CSIRO research would at least match that delivered by the case studies. Therefore, based on the 42 externally validated case studies, the total annual benefits from CSIRO's research would exceed $9 billion per year. This suggests that the full CSIRO research portfolio is providing a return on investment of over 6:1.

In addition, it is recognised that CSIRO provides value through our 'standing capabilities', i.e. the ability to quickly respond to new and sometimes urgent demands for scientific information; through options and royalties generated by our research; our training, education and advisory services; support for STEM talent development; innovation system investments; and national infrastructure and facilities. While it is generally difficult to quantify the potential benefits delivered by these other pathways to value, it is reasonable to argue that they have the potential to deliver considerable additional value.

CSIRO's Business Unit Reviews independently assess progress against the objectives outlined in each Business Unit's strategic plan. Reviews employ a panel of scientific and industry experts from Australia and overseas to assess performance against three dimensions: Impact, Science Excellence and Innovation Capacity. In 2017–18, CSIRO undertook Business Unit Reviews of the CSIRO Astronomy and Space Science (CASS), Energy, Health and Biosecurity, Land and Water, Manufacturing, and Mineral Resources Business Units. For 2017–18, 89 per cent of research programs achieved a strong or benchmark rating on the impact criteria. Overall, the external panels recognised CSIRO's unique role and value in addressing Australia's national challenges. They highlighted that our people are passionate and talented, the excellence of our science and that the capacity to integrate across disciplines enables innovations of national importance for Australia.

The Panel commended **CASS** for the world-leading research conducted by excellent scientists and engineers, and rated the impact as strong to benchmark, indicating a distinguishing and leading contribution to the users of our research. The Panel also saw large potential for commercialisation of technology and services, already evident in the supply of instruments to international customers.

The Panel commended the **Manufacturing** Business Unit on partnerships with the Australian Venture Capital sector, which has led to the creation of several successful startup companies, and the incubator environment for its contribution to the knowledge exchange environment. The Panel assessment of impact was favourable, signifying that outputs enable stakeholders to improve their position relative to peers and competitors.

Health and Biosecurity was found to have widespread evidence for societal and/or economic benefit across the Business Unit, with the Total Wellbeing Diet highlighted for contributing very significant social impact and the Australian E-Health Research Centre recognised as world-class, operating in a growth industry in which Australia is leading the world. The overall assessment by the external panel of our impact was benchmark.

4 Each case study is assessed within the context of a common framework, as outlined in the CSIRO Impact Evaluation Guide. See https://www.csiro.au/en/About/Our-impact/Evaluating-our-impact.

The Panel was impressed by the **Energy** Business Unit's research breadth, from fundamental enquiry projects to delivery of commercial technologies. The impact was assessed as strong to benchmark, representing a distinguishing to leading role in enabling stakeholders to achieve value creation from our work. In particular, the Gas Industry Social and Environmental Research Alliance (GISERA) program was applauded as a model for building stakeholder knowledge and trust in areas of public controversy.

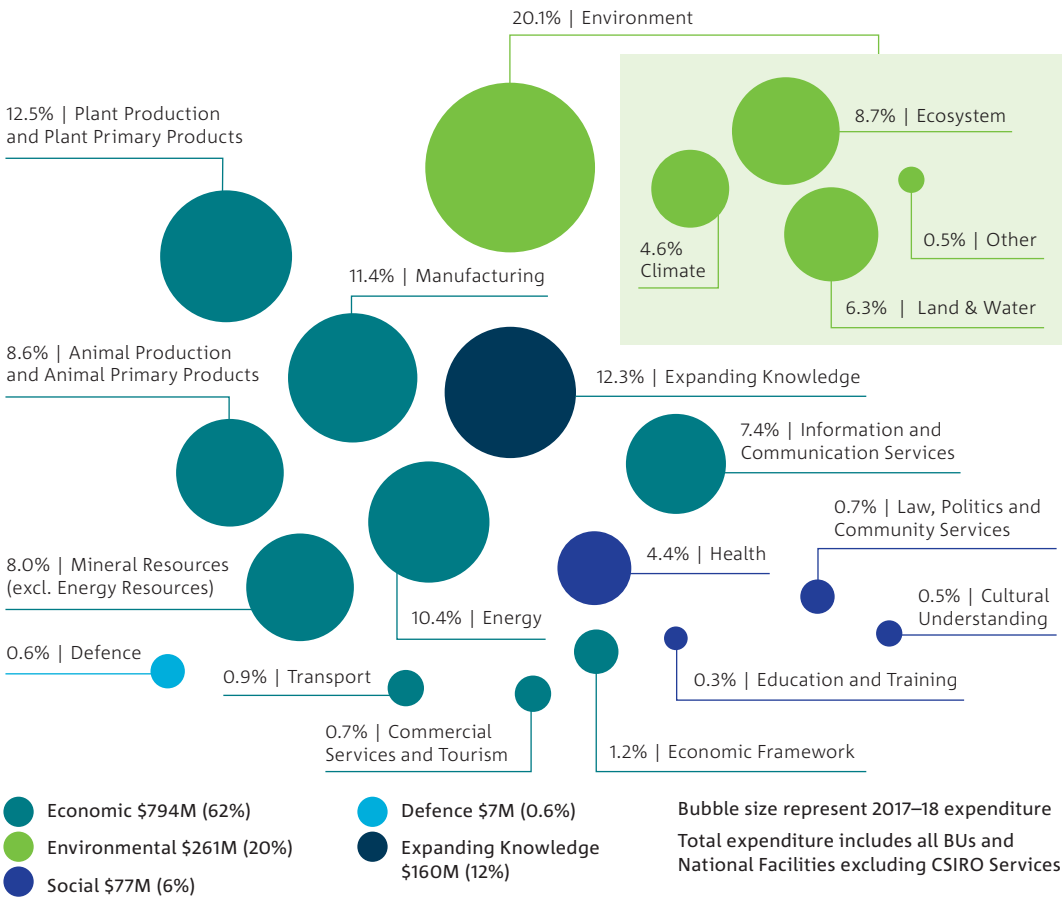
The Panel highlighted the transdisciplinary capabilities and excellence of science of **Land and Water** as contributing to outputs across CSIRO. The impact of the work was assessed as strong to benchmark, recognising the effective application of a differentiated professional skill set in creating benefits for Australia, significantly through co-design of projects with stakeholders in their domain and collaboration with other parts of CSIRO.

Overall, the Panel found outstanding scientific capability and very strong national and international collaborative partnerships for **Mineral Resources**, assessing the impact as strong to benchmark. The research was assessed as well aligned with the needs of the mining industry and well placed to deliver the significant changes required for the industry to flourish.

In 2017–18, CSIRO undertook 36 impact case studies across the Health and Biosecurity, Manufacturing, Minerals, Energy, Agriculture and Food, and Land and Water Business Units, and one cross-Business Unit body of work.

The following examples from our Business Units demonstrate how our world-class research is achieving our purpose to provide benefits to the nation.

FIGURE 3.1: CSIRO INVESTMENT IN SOCIO-ECONOMIC OBJECTIVES IN 2017–18



Agriculture and Food

Life cycle assessment proves environmental credentials, secures lucrative export market

Environmentally sustainable products and services are in high demand by consumers and governments across the globe. Increasingly, suppliers must demonstrate robust evidence of their environmental credentials: are they really as 'green' as they claim? Life cycle assessments provide the necessary framework to account for the environmental impacts of each stage of the life cycle – from production all the way through to disposal.

To protect their industry and maintain market access, the Australian Oilseeds Federation and Australian Export Grains Innovation Centre engaged CSIRO to validate the environmental credentials of the Australian canola industry. New policy, enacted in January 2018 by the European Union (EU), requires biodiesel feedstock to display a 50per cent reduction in greenhouse gas emissions (CO_2-e) compared to fossil-fuel derived counterparts.

In 2016–17, this market was worth $1.8 billion to the Australian farming and export industry, with more than 3.1 million tonnes of Australian canola bound for the EU. The EU market is also worth in the order of an additional $100 million to the Australian industry each year due to premiums offered for non-genetically modified canola, which constitutes the bulk of Australian canola production. Approximately 91 per cent of this canola would be used as a biofuel feedstock, necessitating compliance with the EU's Renewable Energy Directive.

A life cycle assessment, commissioned by industry and performed by CSIRO, secured access to the largest export market for Australian canola.

To measure the environmental impact of the nation's third largest broad acre crop (behind wheat and barley), CSIRO partnered with Victorian firm Lifecycles to calculate the greenhouse gases produced in each process required to deliver canola seed to the farm gate. The research team were supported by the canola industry in Australia and advice from agencies in Europe. The largest emission sources came from the manufacture of fertiliser, followed by nitrous oxide released from crop residues. Values were calculated for each Australian state and across different cropping systems (e.g. irrigated and dryland canola).

A tonne of dry-weight Australian canola seed was found to have on average 497 kg of CO_2-e emissions. EU legislation allows the equivalent of 1,092 kg of CO_2 per tonne of dry grain, making Australian canola an attractive input for biofuel producers, and offering a significant tolerance for additional post-farm gate emissions, such as transporting and refining the canola seed into a sustainable biofuel.

In December 2017, with support from Australian trade officials in Brussels, the European Commission accepted the CSIRO- prepared Australian canola industry report, securing access to this valuable market. The life cycle assessment successfully validated the sustainability of Australia's canola industry.

While Australian canola growers and exporters celebrated the successful outcome, pressure is mounting for other exporting industries to meet similar requirements. Governments are introducing legislation that limit environmental damage caused by pollutants and chemicals released into the ground, air and water. This is coupled with demands from environmentally conscious consumers for industries to supply resources sustainably and ethically, with demonstrated resource efficiency.

CSIRO's life cycle assessment capabilities are available to assist Australia's ~$60 billion agricultural sector to assess its environmental impacts, and to certify compliance of its domestic and global responsibilities amid a changing international backdrop.

Data61

Accelerating Australia's cyber readiness

An estimated 75 billion devices will connect to the Internet by 2025. As the Internet of Things expands and economies become more data-driven, malicious cyber activity is a growing challenge for governments, organisations and individuals worldwide. The need to protect our data and infrastructure is a tremendous economic opportunity, with the cyber security industry itself estimated to reach US $170 billion worldwide by 2020.

Under the Commonwealth's National Innovation and Science Agenda, CSIRO developed a cyber security program to tackle this challenge and support research, commercialisation and collaboration across Australia's cyber sector. Outside of the Australian Department of Defence, we are Australia's preeminent capability in cyber security research. Our research focuses on three forward-looking areas – confidential computing, trustworthy systems and distributed systems security – which have been adopted and recognised internationally.

Since our mathematically proven seL4 microkernel was commercialised in 2006, it has attracted international attention. We are currently collaborating with the US Government's Defense Advanced Research Projects Agency and American multinational company Rockwell Collins on a joint Cyber Assured Systems Engineering project, which is trialling the seL4 microkernel in defence applications.

The seL4 microkernel also secures the Cross Domain Desktop Compositor prototype, developed in partnership with the Defence Science and Technology Group (DST), which provides a means to safely access multiple isolated networks while maintaining system security. The technology received a National Award for research and development at the iAwards in September 2017.

Furthermore, we formalised a $9.3 million partnership with DST, with 17 joint research projects established as a result. The projects were delivered in conjunction with 12 Australian universities across a range of research themes including cyber influence and data analytics, and system design for resilience.

Our cyber security research and development has generated new research outputs and technology, now being trialled and implemented by government and corporates.

From international partners to Australian collaborators, we are accelerating national innovation by fostering collaboration in the cyber sector worldwide. Our newly established Victorian Cyber Security and Innovation Hub brings together industry, academia and government to tackle national challenges. In 2017, we also successfully launched SINET61 (Security Innovation Network), a global cyber security conference attracting 200 executives from industry and government. Both platforms are crucial to opening up global commercialisation pathways for Australian cyber firms.

However, our achievements in cyber security would be incomplete without ensuring the right skills are in place for the nation's future. To foster the next generation of cyber specialists, we have supported 60 Cyber PhD Scholarships in conjunction with Australian universities.

Ribit, our matchmaking platform for students and startups, held a cyber-security-focused event in April connecting 130 students with entrepreneurs from 25 organisations to kick-start their careers. We also created a nationally recognised cyber security curriculum in November in partnership with the Australian Institute of Company Directors. The 'Cyber for Directors' program improves cyber readiness and knowledge in Australia's executives. Over a dozen executives have completed the course to date.

Energy

Lowering emissions from carbon-produced electricity: the Direct Injection Carbon Engine

Global warming, largely caused by increases in greenhouse gases in the atmosphere, is a modern challenge. The associated impacts are significant and require a mix of responses to reduce emissions.

Coal-based electricity provides about 65 per cent of Australia's National Electricity Market supply. Since our current technologies are carbon intensive, we need to implement cleaner and more efficient ways to generate energy from coal, providing an opportunity to build on some of our coal-based infrastructure to increase the penetration of renewable bioenergy into the mix.

The major challenge for coal-fired power generation is to reduce its carbon dioxide (CO2) emissions. While CO2 capture and storage (CCS) has the potential to reduce emissions, both the costs and amount of CO2 that would need to be captured and stored is high, and multiple technology pathways are needed. Increasing the efficiency of energy generation is one such pathway, and CSIRO has been developing technologies for low-emissions electricity from coal and biomass through the Direct Injection Carbon Engine (DICE) project.

DICE is a modified diesel engine running on a mix of coal or treated biomass and water. This advanced technology produces a water-based slurry—a fuel called micronised refined carbon—that is directly injected into a large, specially-adapted diesel engine. This provides power at very high efficiencies.

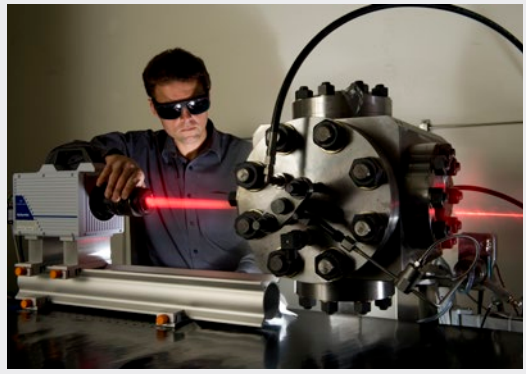
The impacts and benefits of DICE are broad. The high efficiency of power generation, and the ability to work on coal, biomass, or blends of these materials, can bring significant reductions to CO2 emissions from the power sector without the need for large-scale CCS. Since DICE can start up and turn down quickly, it is well-suited to supporting a high penetration of intermittent renewables—such as wind and solar—by smoothing out generation curves or responding to rapid changes in demand. DICE technologies are also modular, providing opportunities for efficient, low-cost power from coal or biomass in remote locations. DICE generation has low water use and low running costs.

Efficient, distributed coal-based power is attractive for Australian applications because it provides a low-emissions role for coal resources. And the renewable bioDICE technology offers a pathway for low-cost power from biomass and waste resources.

CSIRO has collaborations along the technology chain: coal and biomass producers, coal and bioenergy industry bodies, and engine manufacturers to ensure multiple applications for DICE and bioDICE research. With our industry partners, including MAN Diesel and Turbo, and Australia's coal industry, DICE technology will enable Australia's lowest-cost, lowest-CO2 electricity to be produced from coal.

We are also working with the Australian Renewable Energy Agency (ARENA) to show how forestry residue can be used in DICE engines. With ARENA's support, this year we commenced the first stage of the commercialisation of bioDICE—including pilot-scale engine tests, business planning and demonstration plant design.

The adoption of DICE technology has the potential to significantly improve the efficiency and reduce the emissions from coal-sourced electricity generation, both nationally and internationally, and enable the increased penetration of renewable energy from a range of sources.



Advanced instrumentation and diagnostic tools to support the use of micronised refined carbon in DICE engines.

Health and Biosecurity

Life-saving new blood test for bowel cancer wins Eureka award

Bowel cancer, also known as colorectal cancer, causes more than 600,000 deaths worldwide each year. In Australia, it is the second most common cause of death from cancer, with 16,000 cases diagnosed annually.

Up to half of the patients diagnosed with the disease will have a recurrence within the first two to three years following initial diagnosis and treatment. Current practice to identify bowel cancer recurrence is via the detection of carcinoembryonic antigen (CEA) proteins in the blood, in combination with CT scans and other clinical assessments. While CEA is a widely known marker for gastrointestinal tract diseases including bowel cancer, it can give false-positive results, which can increase the strain on the healthcare system and lead to delays in detection for others, lowering the chance of successful treatment. A more reliable test was needed to help improve the health outcomes for people with the disease.

In 2004, CSIRO began a collaboration with Flinders University and Australian-founded biotechnology company Clinical Genomics to identify the genes that were activated or repressed in patients suffering from bowel cancer. This work built on CSIRO's long history in gene expression in an attempt to develop a next-generation approach to diagnosis of recurrent bowel cancer.

The team developed unique technologies for genomic analysis and were able to discover molecular changes that occurred in bowel cancer. By characterising these genomic changes, they were able to develop highly specific tests to detect the cancer-derived DNA – tests which led to a new blood test known as Colvera.

Clinical trials of Colvera show that it is twice as sensitive at detecting recurrence of bowel cancer when compared to the existing CEA test. This more accurate tool improves patients' chances of receiving timely treatment, potentially increasing survival rates.

Clinical Genomics successfully launched Colvera in the US market in December 2016, with the test available through Clinical Genomics' lab in Bridgewater, New Jersey, for monitoring cancer recurrence after initial primary treatment (usually surgery). Cinical trials are in progress for commercialisation of a blood test for primary diagnosis of colorectal cancer. Commercialising this product could increase the potential to save the lives of people affected by colorectal cancer through its early detection.

In 2017, the scientific discovery and life-saving potential of the Colvera team's work was awarded the Johnson & Johnson Eureka Prize for Innovation in Medical Research in Australia, a prize reserved for 'innovation in medical research that is working toward a healthcare solution that has the potential to change and improve people's lives'.

Colvera also took out the 2017 CSIRO Entrepreneurship Award in recognition of the team's entrepreneurial approach and use of passion, persistence and resourcefulness to turn an opportunity into reality.

The Colvera team's success demonstrates how science and industry can create life-saving impact. They hope the test will make it to Australian shores soon.

CSIRO's Dr Peter Molloy, Clinical Genomics' Dr Susanne Pedersen and Flinders University's Professor Ross McKinnon accepting Colvera's 2017 Eureka Prize for Innovation in Medical Research. © Australian Museum.

Land and Water

Collaborative research assesses potential coal resource impacts on water assets

Development of Australia's estimated $2,600 billion of prospective coal and coal seam gas resources in the nation's central and eastern coal-bearing regions ignites passionate debate about the potential impacts on our water resources, and the wetlands, bores and other reliant ecological, economic and sociocultural assets.

This has created a science challenge of unprecedented proportions – to provide the nation's decision makers with transparent scientific information about the potential cumulative impacts of coal resource development on water and the assets that rely on them.

The Australian Government looked to the world-class capabilities of CSIRO in collaboration with the Bureau of Meteorology and Geoscience Australia to undertake the Bioregional Assessment Programme.

This $62 million technical research programme covered more than 860,000 square kilometres of assessment area, over 13 bioregions and subregions across four states and the Northern Territory.

It provided integrated, regional-scale assessments of the cumulative impacts of resource development to inform the government's approach to managing the environmental impacts of coal and coal seam gas development likely to be developed in the foreseeable future, and to support the Commonwealth and states in their development and regulatory decisions.

More than 160 CSIRO scientists and technical experts carried out the assessments alongside state and local agencies, which included more than 50 workshops with industry, government and scientific experts.

Australia is the first country to gather and analyse such a wide range of information on this scale, gathering data about the ecology, geology, hydrology and hydrogeology of the regions. The Programme has produced 104 reports and syntheses, and developed more than 150 terabytes of data, including hydrological models run tens of thousands of times to produce a range of probabilistic analysis of impacts.

Penrith Weir on the Nepean River, NSW, is part of the Sydney Basin Bioregion, one of 13 bioregions assessed in the Bioregional Assessment Programme.

The Programme was completed in June 2018, and its findings are already helping governments, industry and the community by providing information for regulatory, water management and planning decisions. Importantly, the Programme leaves a legacy of publicly accessible data and reports that can be built on to further improve knowledge in key areas and for future resource developments and assessments.

Results of each assessment and all underlying data, models, maps and methods are made publicly available on a Bioregional Assessment Information Platform. This website allows an unprecedented level of transparency, providing the underpinning methods, workflows, data and models that deliver the scientific outputs. The Programme's approach to transparency has led the way for future assessments commissioned by government. Similarly, the Programme's comprehensive uncertainty analysis has become an adopted guideline for groundwater modelling by the Independent Expert Scientific Committee on major coal and coal seam gas developments. A robust uncertainty analysis is important for regulatory decision-making to ensure management options and approaches are in line with the level of risk and its likelihood for any particular impact.

Manufacturing

Carbon fibre – a lightweight, strong and expensive material in growing demand

The carbon fibre composites market will be worth over $31 billion by 2024 according to a recent Global Market Insights Inc. report. Carbon fibre combines high rigidity, tensile strength and chemical resistance with low weight, and is increasingly used across industries like aerospace, automotive, oil and gas, clean energy and sporting goods to replace traditional materials like steel and aluminium. Demand for this expensive material, which is often combined with other materials to form composites, is rapidly increasing within Australia.

Carbon fibre is made by a handful of manufacturers around the world, each of whom hold their own secret, patented recipes for the polymeric feedstock, or precursor required to make the material. To make carbon fibre more affordable for Australian manufacturers, we are collaborating with industry and the research sector to develop carbon fibre that is both cost effective and high performing for Australian companies.

Through the government-supported Australian Future Fibre Research and Innovation Centre, we have collaborated with Deakin University to develop carbon fibre technologies that will produce high-quality, low-energy carbon fibre at low cost. This will allow the technology to be broadly adopted across a range of industries.

Our carbon fibre experts are co-located at Deakin University's Waurn Ponds campus in Geelong where they have access to Deakin's globally unique, open-access carbon fibre/composite research facility, Carbon Nexus. We recently developed our own precursor using our patented Reversible Addition-Fragmentation chain Transfer (RAFT) polymer technology that enables the production of high-quality bespoke materials. This breakthrough allows us to create carbon fibre from the actual starting molecules; a first for Australia. Our 100 per cent Australian carbon fibre was created using CSIRO-produced polymer and white fibre spun on the joint CSIRO/Deakin University wet spinning line, then carbonised at Carbon Nexus.

This collaboration is a significant leap forward in transforming Geelong into an internationally recognised carbon fibre hub. Geelong is already home to companies like Carbon Revolution and Quickstep Holdings Ltd, and we see this breakthrough as an important chapter in the region's innovation story.

Recently, Deakin University licensed its low-energy carbon fibre technology to LeMond Composites in a multi-million-dollar deal that will see LeMond build a carbon fibre manufacturing facility in Geelong. Complementing this is the novel carbon fibre feedstock material that CSIRO is developing. We envisage in the next two years our research will be in a position to attract suitable investment to build a 250 tonne per annum polymer precursor plant, and a 200 tonne per annum white fibre manufacturing plant to directly feed the Carbon Nexus facility and generate 100 per cent Australian made carbon fibre ready for application.

From wind turbines to aerospace, even the latest Mustang wheels, a carbon fibre industry signals the kind of reinvention needed across Australian industry, shifting Australia's focus from raw exports to high-value products to retain its global competitive advantage.

Australia's first entirely home-grown carbon fibre will pave the way for Australian industry to mass produce the next generation materials, growing our manufacturing industry and generating jobs of the future built on home-grown innovation.

Australia's first ever carbon fibre being manufactured in Geelong, where the breakthrough was made.

Mineral Resources

Technology solution improving trust between communities and the mining industry

Australia's mining industry contributes significantly to the nation's economy as its biggest export earner. However, at home and around the world, the industry is facing growing community expectations and must gain and maintain 'a social licence to operate' if it's to have a productive future.

CSIRO research shows that trust between companies and the communities they work alongside is a key factor influencing a social licence to operate. When companies lose community trust, conflict can occur. However, it is difficult for companies to systematically understand the complex sets of issues and concerns held by diverse communities, and communities have few constructive ways to feel heard.

Using world-leading social science methodology, CSIRO has developed a sophisticated solution called Reflexivity, which helps companies and communities engage in a meaningful way and build greater trust.

Reflexivity captures community sentiment and issues in real time via periodic surveys that can be completed via a mobile phone or computer, using sophisticated analytics to translate this data into a language that companies can engage with and respond to. Insights are quickly reported to the community and the company, identifying the factors that build and reduce trust, as well as practical steps that can be taken to address issues.

An important aspect of Reflexivity is that survey data are collected, managed and owned independently by CSIRO. The community sees the same information as the company, providing greater transparency and a new voice that is heard at various levels of management.

As a result, companies can invest resources into the issues that matter most to communities. For the first time, it also provides companies with insights that they can use to benchmark and track their social performance at individual operations and across the enterprise.

Major mining companies are adopting our solution as the world-leading model for building better community relationships. Reflexivity is on a strong commercial footing to grow in the future. Rio Tinto engaged CSIRO in 2017 to roll out Reflexivity through a three-year project in the towns surrounding its iron ore operations in the Pilbara. Several rounds of survey data have since been collected and shared with the community.

Other companies seeking to engage Reflexivity include Terramin, which is testing the solution at a proposed mine site in the Adelaide Hills, and Yamana Gold in Brazil. The solution is applicable beyond the extractive industries and our social licence to operate work has attracted engagement from groups in other sectors such as Australian Eggs in agriculture.

Reflexivity provides a real opportunity for people to voice their opinions and concerns and mining companies with an evidence-based approach to engaging with communities. It provides a foundation from which companies and communities can build social value, while being able to realise the economic benefits that flow from mining and other industrial activity.

Rio Tinto has engaged CSIRO in a three-year project to roll out our Reflexivity solution in the communities surrounding its iron ore operations in the Pilbara. The project is headed up by Dr Kieren Moffat (R).

Oceans and Atmosphere

Australian breakthrough to estimate white shark populations

The white shark, also known as the great white shark, is an iconic species that is internationally protected and listed as vulnerable in Australia. White sharks are long living (up to 60 years) and females have an 18-month gestation cycle, with up to 10 young per cycle. As such, they are slow to recover among depleted stocks. While a National Recovery Plan is underway to protect the population, we still need an estimate of white shark numbers in Australian waters to inform future policy and balance conservation with public safety.

In Australia, white sharks are composed of two populations: an eastern population ranging from eastern Victoria to central Queensland and across to New Zealand, and a southern-western population ranging from western Victoria to north-western Western Australia. As sharks are widely distributed, it has been difficult to provide a scientifically reliable estimate of adult white sharks – until now.

CSIRO has developed a world-first genetic analysis technique to estimate adult white shark numbers for both the eastern Australasian and southern-western white shark populations, all without having to catch or even see any adult white sharks. Instead, we locate the tell-tale marks of the parents in the DNA collected from juveniles, a method known as close-kin mark recapture.

Close-kin mark recapture first involves taking a tissue sample from a juvenile shark and obtaining a genetic profile of that animal; this is then compared to all of the other sharks to determine if the shark is related, and how. This highly detailed genetic data sampling is then combined with a breakthrough statistical method to estimate adult white shark numbers.

Extensive acoustic and satellite tagging of juveniles at two identified nurseries on Australia's east coast provided the scientific evidence to estimate juvenile survival for the eastern population. An estimate of the juvenile survival rates for the southern-western population is not yet known and requires an expanded tagging effort and associated data collection.

Research into juvenile white sharks combined with a breakthrough in DNA sampling has provided the final pieces of information needed to estimate the size of white shark populations in Australian waters.

This CSIRO research published in 2018 reveals that there are about 750 adults in the eastern Australasian white shark population (with a range from 470 to 1,030), with a total eastern population of 5,460 (with a potential range between 2,909 and 12,802). For the southern-western population, the estimate is 1,460 adult white sharks (with a range of 760 to 2,250).

The research is led by CSIRO and is part of the Australian Government National Environmental Science Program – Marine Biodiversity Hub. As part of this work, we are collaborating with scientists from WA Fisheries, NSW Department of Primary Industries, University of Technology Sydney, Flinders University, South Australia Research and Development Institute and South Australia's Department of Environment and Water and Natural Resources.

This innovative research gives government, industry and the community new scientific insight into white shark populations to better understand their movements and is being used to evaluate the success of Australia's white shark National Recovery Plan. While it provides a scientific basis for the Plan, the research is also informing future policy to manage white shark numbers as well as how other conservation-dependent species are assessed.

Science excellence

CSIRO's science excellence can be measured by looking at the frequency with which our work is cited by other research, normalised for subject patterns and the age of the material. This Normalised Citation Impact (NCI) is a standard indicator and allows for global comparison.[5]

CSIRO's NCI is just over 50 per cent higher than the global average, based on publications produced from 2013 to 2017. In comparison, publications from 2012 to 2016 were cited 51 per cent more than the global average. As there is a margin of error of a few percentage points, our citation level is effectively stable.

CSIRO remains in the top quartile when compared with Australian universities, being ranked joint 8th. Last year, the organisation was ranked 7th and the year before was ranked 3rd. The decline in ranking is due to a rapid increase in the NCI of some universities. Another way by which research organisations judge the quality of research is by evaluating research publications.

Overall, the total number of recorded refereed publications has remained steady. The number of refereed CSIRO journal articles and reviews published remains at more than 3,000 per year but has been trending downwards since 2015 (see Figure 3.2). 2016 saw a decline of 234 publications and 2017 a decline of 129 to 3,098 publications.[6] This decline is due to the fall in CSIRO's research staff count in earlier years, lagging that change because of the time it takes to conduct and publish research. However, productivity has not fallen – the total number of refereed papers is still greater than earlier years when staff numbers were higher. For example, in 2012, there were 3,074 publications for 6,477 staff, compared to the current result of 3,098 for 5,767 staff.

The number of refereed conference papers recorded in the ePublish system has increased from 364 in 2016 to 500 in 2017, with the effect that refereed publication output overall is stable.

Journal articles are the main type of research publication produced by CSIRO, followed by conference papers and client reports (see Figure 3.3).

CSIRO produced 682 client reports and 278 technical reports during 2017; this was 103 more client reports than last year, but 124 fewer technical reports.

FIGURE 3.2 CSIRO JOURNAL OUTPUT BY YEAR 2013–17[7]

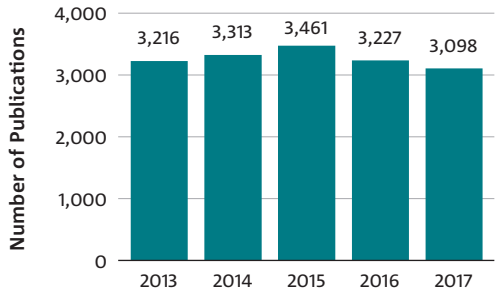
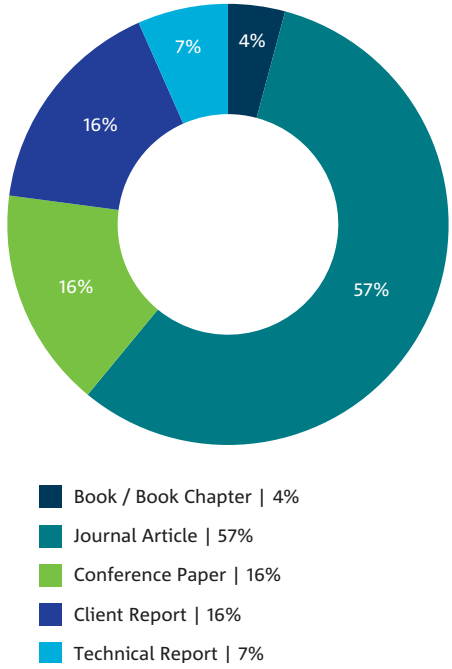


FIGURE 3.3: PERCENTAGE OF PUBLICATIONS BY TYPE, 2017

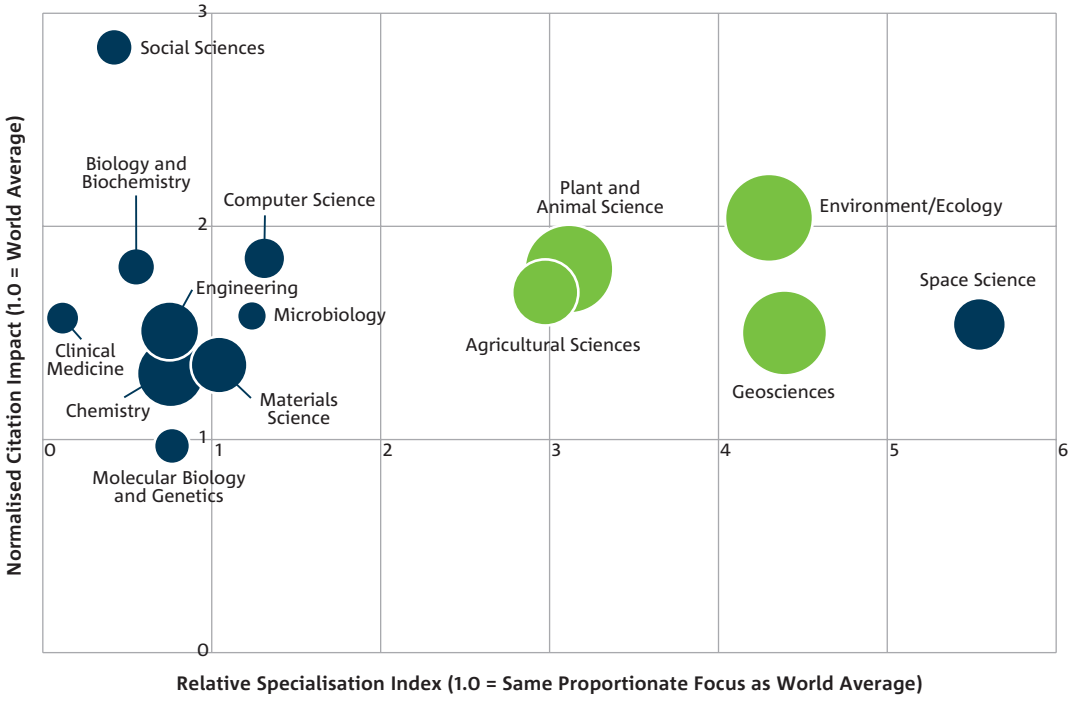


5 The data are taken from the citation index Web of Science.
6 These totals have changed since the last annual report as more content has been indexed on Web of Science.
7 Publications are reported on a calendar years basis, as accurate publication counts are not available until significantly after the end of a financial year, due to the time lag between a publication being published and it being indexed.

We produce publications in a range of research fields. Figure 3.4 shows CSIRO's focus on, and strength in, each of the 14 fields in which we are consistently ranked in the top 1 per cent of institutions globally. On the horizontal axis, a value of 2 would show that CSIRO specialises in this field two times as much as the global average, while on the vertical axis a result of 2 would show CSIRO is cited two times as strongly as the global average. The size of each bubble corresponds to the level of CSIRO output in that field.

Fifty-two per cent of our publications are in the four fields for which we are most strongly ranked for total citations, appearing in the top 0.1 per cent of institutions globally, which are marked in green. We have held this position in these four fields for 13 years – as long as CSIRO has tracked this performance.

FIGURE 3.4 CSIRO PUBLICATION FOCUS AND CITATION IMPACT BY RESEARCH FIELD 2008–17



CSIRO Publishing

CSIRO Publishing operates as an editorially independent science publisher within CSIRO on behalf of authors and customers in Australia and overseas. Our publishing program covers a wide range of scientific disciplines, including agriculture, chemistry, plant and animal sciences, and the environment. We are Australia's only endemic, scholarly science publisher with a significant digital capability. We provide a viable, local publishing option for authors, CSIRO itself, and for learned and professional societies to publish scholarly content that champions Australian research.

During 2017–18, we published 27 journal titles. Fourteen titles were published in partnership with the Australian Academy of Science, a successful relationship dating back to 1948. Thirteen journals were produced under agreements with Australian and international societies or institutions. Additionally, special issues of journals were published in connection with societies and international conferences.

These journals are available free to developing countries through the United Nations program Research4Life. This program fosters scientific understanding and education in developing nations. Online use of the journals resulted in 2,780,877 articles being downloaded.

Collaborations and awards

During 2017–18, CSIRO Publishing released 30 book titles in print and digital formats. The digital books comprised approximately 8 per cent of sales.

We continued collaborations with The Natural History Museum, London, Cornell University Press, Princeton University Press, Bloomsbury and CRC Press, co-publishing books that had significant international relevance.

Industry and professional recognition for our program was highlighted by the awards won by our bestselling title *The Australian Bird Guide*. This important work won the 2017 Whitley Medal and the Australian Book Industry Awards Small Publishers' Adult Book of the Year.

Net profit

CSIRO Publishing delivered a net profit of $550,894 for 2017–18. Total revenue for the period was $9,915,200.

TABLE 3.2: CSIRO PUBLISHING READERSHIP

	2015–16	2016–17	2017–18
CSIRO Publishing journals* (downloads)	2,901,602	4,224,132	2,780,877
Double Helix Magazine (subscribers)	7,216	6,687	6,521
*Double Helix Extra*** (email subscribers)	43,029	42,017	40,000

*Downloads in 2016–17 were inflated by robotic crawlers that have been filtered out in 2017–18
**Previously *Science by Email*

Strategic innovation investment

Our aim as Australia's innovation catalyst is to help reinvent existing industries, create new industries for Australia and deliver public good. A key mechanism to achieving this is our investment in cutting-edge, potentially transformative science through our Future Science Platforms (FSPs) and to help translate such science into commercial opportunities through the CSIRO Innovation Fund.

In 2017–18 investment in FSPs grew to 151 per cent of the 2014–15 baseline, representing growth of $16.7 million. The investment was slightly less than the target of $18 million, with a prudent approach taken to the allocation of funding in the early stages of two new FSPs established during the year.

This year we created the Hydrogen Energy Systems and Precision Health FSPs. Both these new FSPs are aligned with government direction as key fields for scientific focus and investment. The Synthetic Biology FSP hosts a new 'Responsible Research and Innovation' activity, which supports all FSPs in ensuring their research is socially responsible.

Our Future Science Platforms are:

Probing Biosystems	A revolution in healthcare and agriculture through devices and systems to obtain real-time information from living organisms about their health and wellbeing. This will lead to the ability to provide health and medical interventions that are timely, customised and highly specific.
Digiscape	Harnessing the digital revolution for Australian farmers and land managers. We will solve multiple real-life knowledge shortfalls in the land sector simultaneously by building a common big data infrastructure that will support next generation decision-making and transform agricultural industries and environmental action.
Synthetic Biology	The application of engineering principles to biology. It involves the design and construction of biological systems and devices, based on DNA-encoded componentry, and their application, where appropriate, to advances in areas including manufacturing, industrial biotechnology, environmental remediation, biosecurity, agriculture and healthcare research.
Environomics	Australia's environment is immensely valuable but difficult to manage because of its size and complexity. Capitalising on the genome sequencing revolution and big data science, Environomics is reinventing how we measure and monitor ecosystem health, predict biodiversity responses to environmental change and find new resources in nature.
Deep Earth Imaging	Our ability to find and exploit Australia's future minerals, energy and water resources from far greater depths in the Earth and from deep offshore sources is limited by the deep and complex cover of sediments and weathered material that covers 80 per cent of Australia's land mass. This science will help us more precisely image subsurface rock properties to unlock the potential of this vast and relatively under-explored area.
Active Integrated Matter	A new technology platform combining materials, robotics, processing and sensing technologies, and autonomous science to lead ground-breaking advances at the interface of big data, advanced autonomous systems and materials science. Advances at these interfaces will drive the i-manufacturing or manufacturing 4.0 revolution and put early adopter industries ahead of the competition.
Hydrogen Energy Systems	Australia has access to vast energy resources through sun, wind, biomass, natural gas and coal, all of which can be used to produce hydrogen and/or the desired energy carrier compound. The fuel could be used domestically in transport, power generation and to offset more carbon-intensive resources, and Australia could also become a world-leading exporter of low emissions hydrogen.
Precision Health	Australia's healthcare system is focused on treating illnesses, but to keep up with our ageing population the focus needs to switch to keeping healthy people healthy. Through engagement with the community to a more tailored healthcare paradigm and building on programs already underway in the medical field, we will focus on creating an integrated platform to proactively manage a person's health throughout their life.

The CSIRO Innovation Fund 1, LP aims to improve the translation of publicly funded research into commercial outcomes and stimulate innovation in Australia. In 2017–18, we focused on continuing the establishment of the Fund, managed by CSIRO subsidiary Main Sequence Ventures. The Australian Securities and Investments Commission approved Main Sequence Ventures' Australian Financial Services Licence in July 2017, and nine investments have been made. The team has been engaged in sourcing investable opportunities from the publicly funded research sector as well as seeking private sector investment to match CSIRO and government contributions to the Fund. Innovation and Science Australia unconditionally registered the Fund as an early stage venture capital limited partnership in February 2018. Private sector investors have been identified and informally committed to the Fund, with formal commitments to be finalised by the end of July 2018.

University engagement

CSIRO partners with universities to ensure the best available research is used to deliver outcomes in areas of national priority. Our engagement with universities takes multiple forms, such a collaborative research and co-publication, student supervision (see page 51) and partnering with 20 Australian universities on the ON program, creating a truly national sci-tech accelerator.

ON conducted three formal programs and associated activities throughout the year. Along with supporting runway and ecosystem services, these included one ON Accelerate program (70 per cent university teams, 30 per cent CSIRO teams) and two ON Prime pre-accelerator programs (delivered over 15 hubs and serving 439 participants nationally) designed to support teams from across CSIRO, the university sector and other publicly funded research agencies. More than 300 participants were from Australian universities; over 93 per cent of these participants reported a high willingness to recommend ON programs to their colleagues and other prospective participants. We believe this to be an indicator of the need for science accelerator and associated programs in the research sector and the proficiency and effectiveness of the delivery of the programs by CSIRO. A high willingness to recommend is expected to continue into the future as the program offerings are developed and expanded in response to the needs of Australian researchers.

Other highlights of our university collaboration this year included:

- **Earth Systems and Climate Change Hub**: Funded by the Australian Government's National Environmental Science Program, CSIRO is partnering with six Australian universities to help address major challenges that the changing climate poses for Australia. During 2017–2018 the Hub built its early career researcher (ECR) cohort and established the PhD affiliate initiative to provide university-based ECRs and PhD students with access to expert capabilities and professional development opportunities by virtue of the collaboration between Hub partners.
- **Centre for Southern Hemisphere Oceans Research (CSHOR):** A research partnership between the Qingdao National Laboratory for Marine Science and Technology, CSIRO, the University of New South Wales and the University of Tasmania, the goal of CSHOR is to improve our understanding of how the southern hemisphere oceans influence global and regional climate. In 2017–18, the Centre recruited 10 scientist and held its first joint Steering Committee and Advisory Committee meeting. Six papers were published during the year in the prestigious journal Nature.
- **Pawsey Supercomputing Centre**: Based in Perth, Pawsey is one of two peak high-performance computing facilities in Australia. We own and operate the Centre in a joint venture with Western Australia's four universities and with support from the National Collaborative Research Infrastructure Strategy and Western Australian Government. In 2018, the Australian Government awarded $70 million to the Centre to replace its existing infrastructure, which has enabled us to drive innovation and accelerate discoveries in several areas including medical science, astronomy, geoscience, marine science, chemistry, food and agriculture.
- **Industry PhD program**: This industry-focused applied research training program aims to produce the next generation of work-ready research and innovation leaders in Australia. We piloted the program with the University of New South Wales in March and are in discussions with another four universities to involve them in the program from early 2019.

Customer and user satisfaction

Relationships we build with our customers are fundamental to our success as an innovation organisation. During 2017–18, CSIRO again used the comprehensive industry benchmark, Net Promoter Score (NPS) methodology, to determine customer satisfaction. The NPS for 2017–18 was +40, which is a significant improvement from +34 last year and +11 the year before.

Customers affirmed CSIRO's excellence, professionalism and role as trusted partner. They like the way they are treated (87 per cent), that we are willing to help (83 per cent) and that we value their opinion (80 per cent). Seventy-three per cent say we offer innovative solutions and 78 per cent say they will stay with CSIRO in the next twelve months. Of the key metrics, customers say that CSIRO is better (compared to last year) in our empathy and reliability, ethics and science quality. Their trust in, and commitment to, CSIRO has increased and overall satisfaction (with price, quality and service) is higher at 70 per cent.

However, there are areas where we can continue to improve: response times, staff availability and length of contract and legal processes. Our customers are facing challenging industry conditions and are looking to CSIRO to partner with them for solutions. They notice improvements in relationships and that we have become more customer focused with a greater willingness to collaborate.

$671.5 million
worth of commercial agreements this financial year

Deal sizes were over 80% higher than past 5-year average

The consistent high levels of satisfaction and advocacy from customers reflects CSIRO's value add and impact to our customers and partners.

In 2017–18, CSIRO engaged with 2,400 customers, generating over $400 million of revenue from research, consultancy and testing services, and earning $43 million as royalty and licence revenue from applied technology. We entered into nearly 2,000 new commercial agreements totalling $671.5 million. The average contract value was over 80 per cent higher than the previous five-year average. CSIRO's top ten contracts in 2017–18 were valued at $157 million, representing 24 per cent of the total of all commercial contracts signed this year.

85% of customers think we perform ethically

85% of customers think our science is high quality

87% of customers like the way they are treated

Industry partnerships

Applying our research directly to industry is central to our purpose. In 2017–18, CSIRO worked with 355 large corporates, 488 international customers and over 1,000 small and medium-sized enterprises (SMEs).

Highlights of our industry collaboration this year included:

- **Chrysos**: In 2016, we partnered with a network of experienced investors and industry professionals to create Chrysos Corporation Limited (Chrysos) to commercialise our PhotonAssay technology, which enables mining companies to rapidly detect small traces of gold, allowing them to optimise their mining and mineral processing operations. In 2017, Chrysos and CSIRO, with manufacturing partner Nuctech Company Ltd, delivered the first operational photon assay system to Ausdrill's MinAnalytical facility in Perth, with two more systems to be established in the Kalgoorlie goldfields in the coming months.
- **Amfora**: A CSIRO-developed technology has made it possible to produce oil in the leaves, stems and other biomass of plants. This opens up new opportunities in the global production of renewable oils for human food, stock feed, biofuels and other industrial uses. In 2017, we joined forces with Amfora, a US-based company, to further develop and commercialise this technology to produce high-energy feed for livestock. The agreement with Amfora is the first major application for the vegetative oil technology. CSIRO is a significant shareholder with a royalty-bearing licence and research and development contract funding ongoing science, especially into the production of biofuels.
- **Boeing**: 2017–18 was the second consecutive year that CSIRO picked up the Technology Supplier of the Year award from Boeing. Selected from a field of more than 13,000 suppliers from 50 countries, CSIRO was one of 13 organisations, and the only one from Australia to be recognised this year.

CSIRO strives to align our world-class science with key industry sectors. The Industry Growth Centres Initiative is an industry-led approach to focus science and research in key areas with an aim of delivering commercial outcomes. The initiative covers six industry sectors:

- Advanced Manufacturing
- Cyber Security
- Food and Agribusiness
- Medical Technologies and Pharmaceuticals
- Mining Equipment, Technology and Services
- Oil, Gas and Energy Resources.

In 2017–18, CSIRO delivered Industry Roadmaps for two sectors: Oil, Gas and Energy Resources, and Food and Agribusiness. We completed roadmaps for the other sectors in 2016–17, except for the Cyber Security roadmap – the last in the series – which we will deliver in 2018–19. These roadmaps are an important step in working with Australian industry to understand current and future trends.

Another way CSIRO supports collaboration between industry and research institutions is through our SME Connect programs, designed to bring together SMEs with Australia's best researchers and facilities. The goal is to help SMEs become Australia's next innovation success stories. In 2017–18, SME Connect facilitated 200 research projects nationally, injecting over $25 million into research and development. In addition, 138 SMEs were connected with 33 Australian research organisations, including 24 universities as well as CSIRO. We also facilitated 32 graduate placement grants.

SME Connect

Supporting an Australian business to create value in the global supply chain

One of the successes of SME Connect this year was our partnership with Air Radiators. As a key component supplier to a major global mining equipment customer, the business was presented with an opportunity to supply a number of large heat exchanger unit prototypes for testing, in a tight deadline and to certain specifications. The opportunity depended on Air Radiators arriving at an innovative solution that overcame some perceived challenges. Firstly, they identified that their existing solder may not be able to withstand the higher temperatures that had been specified by the customer, potentially compromising their heat exchange product. With some metallurgy capabilities and a small lab Air Radiators went as far as they could to understand the mechanism of failure. After realising they didn't have the metallurgy capabilities in-house to fully understand this problem, CSIRO's SME Connect team was called in to help.

Through the Federal Government's Innovation Connections program, SME Connect facilitated a grant that partnered Air Radiators with a CSIRO research team on a project to fast-track and better understand what was happening with their solder alloys at a microscopic level.

Together CSIRO and Air Radiators developed a simple benchtop test in order to reduce overall validation testing times of the solder. The former test, which involved running SEM (scanning electronic microscopic) images of the solder regions after the radiator had accumulated 1 million temperature cycles, historically took a month or two to complete – an unviable timeframe to meet their customer deadline. Using the newly designed test, this time was vastly reduced to 1-10 days.

The more efficient testing quickly revealed that structural changes to the alloy during the heating process meant Air Radiators' current process technology was in fact able to meet the requirements of their customer.

From the collaborative research project, Air Radiators discovered that their own core baked process changed that solder alloy such that it actually created a leaded concentrated layer. *'With this new knowledge the testing and validation revealed an elevation in the melting point from about 189 degrees through until somewhere in the vicinity of 240-250 degrees'* (Air Radiators Product Development). Once they were able to run 1 million cycles and validate the existing product, Air Radiators shipped their product to the satisfied key customer, meeting their deadline and reinforcing Air Radiators' value in the global supply chain.

The search is now on in Phase 2 of the project for an alternative to solder that withstands the same high temperatures. Together CSIRO and Air Radiators are continuing to create new knowledge and produce new and substantially improved products designed to meet global requirements.

Senior Experimental Scientist Teresa Kittel examines microscopic images of metal composites at CSIRO's Metal Industries labs.

Cooperative Research Centres

The Cooperative Research Centres (CRCs) program supports collaborations between researchers, industry and the community to foster high quality research in areas identified by industry. The Australian Government has funded 221 CRCs since the program was established in 1991, with 32 CRCs active in 2017–18. Over the years, CSIRO has contributed to over 150 CRCs and participated in 14 during 2017–18.

A key highlight for us this year was becoming a member of the CRC for Developing Northern Australia Ltd (CRCNA). CRCNA was formed in July to create a prosperous, sustainable, vibrant and healthy Northern Australia. This year CSIRO-CRCNA worked on two key areas:

- Our first project uses CSIRO's new healthcare technology, Remote-I, via satellite broadband to help prevent blindness in remote communities. It's a high tech but simple solution to a widespread problem known as diabetic retinopathy, or DR, experienced by Aboriginal and Torres Strait Islander peoples. In collaboration with CRCNA, we will use this technology for eye screening and testing in Northern Australia.
- We are also working with CRCNA to scope and build traditional owner-led bush products. CSIRO is researching potential opportunities in areas such as investment and supply chain, and helping frame key development priorities.

CRC-P grants were announced in 2015–16 to support short-term, industry-led research. CRC-Ps are generally small collaborations that operate on project timelines of up to three years and grants of up to $3 million. CSIRO participated in three during 2017–18.

CRC-Ps 1st Selection Round Projects:

- Printed Solar Films for Value-added Building Products for Australia CRC-P

CRC-Ps 2nd Selection Round Projects:

- Large Area Glass Perovskite CRC-P
- Oventus CRC-P (targeted therapy for sleep apnoea).

In 2017–18, the total cash and in-kind contribution to CRCs and CRC-Ps was $13.5 million.

Government partnerships

In 2017–18, CSIRO worked with 311 Australian Government customers.

One of our key customers this year was the Department of Environment and Energy. We helped this Department to develop policies and programs to address some of the major environmental and energy issues facing Australia. This included work on:

- **The Great Barrier Reef** – we are developing the new Reef Restoration and Adaptation program with partners such as Australian Institute of Marine Science. This program will deploy existing and novel technologies to help recovery and repair, and build resilience of the Reef.
- **Hydrogen** – we are working with the Department on a Hydrogen Challenge, established within Mission Innovation, a global initiative of 23 countries and the European Union to dramatically accelerate global clean energy innovation.
- **Data Integrative Partnerships for Australia** – we are playing a lead role in supporting the Department to coordinate environmental data and use this data effectively to better manage Australia's environmental assets.

Intellectual property

At the end of June 2018, CSIRO had 686 patent families, 420 trademarks and 86 Plant Breeder's Rights. While the number of new inventions filed observed a slight decrease over the previous financial year, it remains consistent with the last five years, and the number of live patent cases and granted patent rights has experienced good growth. This is the result of an increase in overseas patent filings during the financial year, which is a good indicator of investment into existing technology making its way through the pipeline.

An increase in overseas trademark filings highlights our focus on global strategy. Of the intellectual property (IP) assets listed in Table 3.3, 49 per cent 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 a key indicator of research and development uptake and adoption by customers and collaborators. The total number of active licences recorded as at 30 June 2018 was 497,275 of which have generated revenue.

This represents a 2 per cent increase in the number of revenue-generating licences and a 7 per cent decrease in the number of non-revenue-generating licences compared to the previous financial year. Underlying IP revenue has increased 35 per cent this year, demonstrating that commercial utilisation of our intellectual assets is increasing. This does not include revenue from WLAN since 2016–17, which was received through a settlement process.

35%
increase in revenue from licenses this year

As shown in Figure 3.5, Asia, North America and Australian patent filings remain at the forefront of CSIRO's IP Strategy, with these three regions accounting for 64 per cent of CSIRO's patent portfolio. The total number of live patent cases in Asia has been increasing steadily over recent years, with approximately 25 per cent in Japan, China, India, South Korea, Hong Kong, Malaysia, Indonesia, Singapore, Vietnam, Taiwan, Thailand and the Philippines. Notably, there was a significant increase in South American filing during 2017–18. There has been a slight decrease in the number of filings in regions such as Africa and South America. These regions represent a relatively small portion of our patent portfolio.

FIGURE 3.5: CSIRO'S STANDARD PATENT CASES[8] BY GEOGRAPHIC REGION

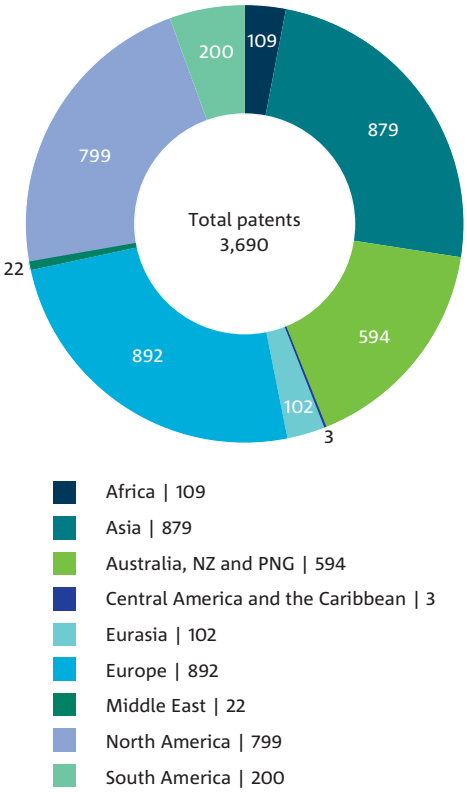


TABLE 3.3: CSIRO INTELLECTUAL PROPERTY PORTFOLIO

IP CATEGORY	SUB CATEGORY	2013–14	2014–15	2015–16	2016–17	2017–18
Patents	Current Cooperation Treaty (PCT) applications	56	78	75	59	53
	Granted	1,755	1,854	1,959	2,122	2,140
	Live cases	3,506	3,430	3,544	3,773	3,876
Inventions	Patent families	644	578	595	692	686
	New provisional and direct filings	66	63	70	79	67
Trademarks (live)	Australian	257	250	251	238	264
	Foreign	91	63	62	94	156
Plant Breeder's Rights (live)	Australian	91	89	89	90	61
	Foreign	26	25	25	26	25
Registered designs (live)	Australian	2	2	2	2	2
	Foreign	6	6	6	6	3

8 The total patents reported excludes Patent Cooperation Treaty (PCT) and Provisional Application filings, as these by themselves do not give rise to a patent right. The total number of 'live cases' reported in Table 3.3 does include PCT and Provisional filings.

Equity portfolio

We systematically partner with companies, large and small, best placed to take new technologies to market and deliver positive outcomes for Australia. CSIRO licenses technology to companies where it is deemed the most likely to maximise IP value. We also directly create new high-technology SMEs through spinning out IP when we consider this to be the best pathway to commercialisation.

CSIRO's equity holdings are represented by ordinary shares, convertible notes and investments in the CSIRO Innovation Fund 1, LP and units in a pre-seed investment fund. Currently, CSIRO has interest in 29 listed and unlisted companies with a total market value of $1,366 million (total market value increases to $1,454 million with the addition of CSIRO special purpose vehicles).

8x increase of our total equity holdings over the past three years

CSIRO's shareholding interest in this equity portfolio (Table 3.4) at 30 June 2018 was $98.7 million, representing an increase of $28.9 million from June 2017, $49.3 million in the two years since June 2016 and $86.1 million in the last three years. A major contributing factor of the increased valuation of the total portfolio was additional investments in unlisted companies, followed by an increase in fair value of the unlisted and listed companies. During 2017–18, the CSIRO Innovation Fund 1, LP increased by $10 million in government funding.

CSIRO established the company Digital Agricultural Services Pty Ltd, which provides business intelligence, property data, farm management analytics and real-time monitoring to banks, insurers, real estate, government, agricultural product suppliers, trading houses and farmers.

CSIRO became a shareholder in Coogee Titanium Pty Ltd, which produces a wide range of industrial, agricultural and mineral processing chemicals or supply to both the Australian and international market. CSIRO became a registered holder of 7,711,496 unsecured convertible notes valued at $7.7 million.

In March 2017, CSIRO converted its two convertible notes (including interest) and coupon rates (total value of $5.3 million) in Biofiba Pty Ltd into 123,777,082 shares, resulting in a shareholding of 20.7 per cent. In June 2018, various investors made further investment in the company at $0.025 per share. This revalued the company at $3.1 million.

CSIRO became a shareholder in Energy OS Pty Ltd (formerly HabiDapt Pty Ltd), an Australian company creating the most advanced mass-market energy services infrastructure of its kind for the residential and SME sectors. CSIRO became a registered holder of 281,028 shares valued at $0.6 million.

HySILL Pty Ltd deregistered on 19 July 2017. The IP was transferred back into CSIRO for commercialisation.

TABLE 3.4: VALUE OF CSIRO'S EQUITY HOLDINGS

	2014–15	2015–16	2016–17	2017–18
Listed and unlisted companies	$8,969,522	$8,930,281	$19,541,035	$37,948,573
Unlisted special purpose vehicles (SPV), CSIRO Innovation Fund 1, LP and Unlisted Unit Trust	$3,631,396*	$40,515,560	$50,279,196	$60,766,039
Total	**$12,600,918**	**$49,445,841**	**$69,820,231**	**$98,714,613**

*Includes only SPV

Activity 2:

Developing national science talent

Year 10 students from John Calvin School in Western Australia, viewing the butterfly and moth installation at the CSIRO Discovery Centre in Canberra.

Engagement in and an understanding of science, technology, engineering and maths (STEM) disciplines will be an important skill required of our future generations. CSIRO Education and Outreach is focused on delivering high-quality, engaging STEM learning experiences for primary and secondary schools and teachers to help ensure all Australian students are equipped with the skills needed when entering the workforce. Through our science outreach programs, we aim to promote the importance and application of CSIRO research to the community and increase Australia's STEM literacy. CSIRO also supports undergraduate, postgraduate and postdoctoral researchers to boost the calibre of researchers working in Australian industry and strengthen our future innovation capacity.

Programs for primary and secondary school students

CSIRO Education and Outreach has education specialists and facilities in each capital city as well as in Townsville, Cairns and Newcastle. This year, 151,720 primary and secondary students took part in hands-on science education programs.

In 2017–18, we delivered:

- STEM Professionals in Schools (formerly known as Scientists and Mathematicians in Schools)
- Sustainable Futures
- BHP Billiton Foundation Indigenous STEM Education Project
- BHP Billiton Foundation Science and Engineering Awards
- CSIRO's Creativity in Research, Engineering, Science and Technology (CREST) Awards (formerly known as CREativity in Science and Technology Awards)
- CSIRO Discovery Centre and Digital Careers programs.

The STEM Professionals in Schools program partners STEM professionals with primary and secondary teachers around the country. By 30 June 2018, 1,684 STEM Professionals in Schools partnerships were operating in 1,218 schools. Of these, 22 per cent were in rural and regional schools and 42 per cent were in schools where more than 25 per cent of the students were Aboriginal or Torres Strait Islander.

The BHP Billiton Foundation Indigenous STEM Education Project increases the participation and achievement of Aboriginal and Torres Strait Islander students in STEM in schools and on to employment. The program is in its fourth year and is successfully delivering all program elements. In 2017–18, we estimate that 725 teachers and teacher assistants and 49,215 students (of which 11,704 were Aboriginal and Torres Strait Islander students), in 151 schools took part in school programs. Twelve communities were involved in community programs and 27 students were enrolled in the Bachelor of Science (Extended) at the University of Melbourne.

CSIRO Sustainable Futures worked with 1,139 schools Australia-wide to help them understand the science behind climate change and how to reduce their carbon footprint.

The Digital Careers program increased student participation and interest in ICT courses and careers. During 2017–18, 99,136 students took part in the suite of Bebras computational thinking challenge programs and 1,065 students took part in the Young ICT Explorers program.

In 2017–18, CREST helped over 5,436 school students plan and conduct research projects. This year, to increase the engagement in and impact of the program, the team developed resources to align with the Australian Curriculum and to include investigations across the spectrum of STEM. Many students went on to participate in the BHP Billiton Foundation Science and Engineering Awards that recognise outstanding scientific research and technology projects by school students. Last year, 12,567 students entered the awards.

TABLE 3.5: SUMMARY OF OUR PERFORMANCE FOR ACTIVITY 2

KPI AND METRIC	TARGET	RESULT	
Utilisation of science outreach programs as measured through participation	5% increase in participation compared to 2015–16	G	We increased total number of visitors and education program participants by 10.5% compared to 2015–16

Green shading indicates positive progress for the year and the target has been achieved.

We host the CSIRO Discovery Centre in Canberra, and major visitor centres at observatories near Parkes and Narrabri in NSW and the Canberra Deep Space Communication Complex (CDSCC). These centres are purpose-built to showcase our research in an entertaining way that demystifies and educates people of all ages about research and innovation. Education and outreach programs at CDSCC attracted 10,270 school students during 2017–18. The total number of general visitors was 69,275.

The visitor centre at the Parkes radio telescope welcomed 105,085 visitors in 2017–18.

The PULSE@Parkes program attracted 100 students, 30 teachers and 180 university students, staff and professionals.

At the Australia Telescope Compact Array at Narrabri, 12,081 visitors in 2017–18 took self-guided tours of the visitor centre. This continues to be highly popular with families, schools, photography clubs and seniors' groups.

Programs supporting university students

CSIRO gives undergraduates the opportunity to collaborate with scientists to help them develop their skills and meet the increasing demand for Australia's STEM capability. Several programs run throughout the year providing this opportunity, such as industrial traineeships, vacation scholarships, and opportunities for Aboriginal and Torres Strait Islander peoples. Through collaborative efforts with industry, we are optimising STEM school-to-industry partnerships, helping science students to progress their careers and supporting the exploration of frontier science.

Our Postgraduate Scholarship Program provides opportunities in science and engineering for outstanding graduates who enrol at Australian tertiary institutions as full-time postgraduate students for research leading to the award of a PhD.

TABLE 3.6: SCIENCE OUTREACH: EDUCATION PROGRAMS

PROGRAM	2013–14	2014–15	2015–16	2016–17	2017–18
CSIRO Science Education Centres (visitors)	366,305	154,825	0[9]	0	**0**
Creativity in Research Engineering Science and Technology (CREST) Awards (participants)	11,048	10,805	9,600	5,579[10]	**5,436**
BHP Billiton Foundation Science and Engineering Awards (participants)	**7,125**	**8,146**	**7,639**	**10,950**	**12,567**

TABLE 3.7: SCIENCE OUTREACH: VISITOR CENTRES

CENTRE	2013–14	2014–15	2015–16	2016–17	2017–18
CSIRO Discovery Centre (visitors)	120,000	33,189[11]	18,477[12]	26,332	27,622
Parkes radio telescope (visitors)	84,698	68,427	95,212	83,851	105,085
Canberra Deep Space Communication Complex (visitors)	67,554	61,051	67,378	70,753	69,279
Australia Telescope Compact Array, Narrabri (visitors)	12,500	10,971	11,511	10,965	12,081

9 The state-based science education centres closed in late 2014.
10 The focus of the CREST program for the last two years has been on refreshing and developing new resources to ensure alignment with the Australian curriculum and include investigations across the spectrum of STEM.
11 In 2014, we changed our operating model and opening hours to focus on STEM education activities, not general community events.
12 Closed for renovations during part of the year.

Students are deemed to be supervised if they have a CSIRO staff member appointed officially by the university as the supervisor for their research project. Normally, CSIRO staff are joint supervisors in conjunction with a university academic.

Students are considered sponsored if they receive a full or partial scholarship paid from CSIRO funds to pursue a research project leading to a PhD or Honours/Master's degree. This excludes CSIRO employees, whose study expenses are considered to be training and development.

In the past year, 2,456 undergraduates, postgraduates and postdocs participated in our programs.

22% increase in postgraduates this year

TABLE 3.8: CSIRO STUDENTS AND POSTDOCTORAL FELLOWS IN THE 12 MONTHS 1 JUNE 2017 TO 31 MAY 2018

TERTIARY LEVEL	2017–18
Undergraduate students	633
Postgraduate students	1,438[13]
Postdoctoral fellows	385
Total	**2,456**

The number of students fluctuates within any given year and across years, as uptake to programs varies and students conclude programs at different times of the year. Table 3.9 provides a comparison with previous years of the numbers of students that we supervised, or sponsored and supervised. The numbers represent a point in time only, 31 May 2018, and not the total number for the year.

TABLE 3.9: SCIENCE OUTREACH: CSIRO STUDENTS AS AT 31 MAY 2018

	2013–14	2014–15	2015–16	2016–17	2017–18
Undergraduates					
Total	**-**	**-**	**-**	**-**	**100**
Sponsored postgraduates[14]					
PhD	254	224	280	416	418
Masters	19	16	36	27	12
Honours	23	10	19	16	7
Total	**296**	**250**	**335**	**459**	**437**[15]
Supervised postgraduates[16]					
PhD	601	621	599	673	816
Masters	90	70	132	115	159
Honours	61	70	70	68	67
Total	**752**	**761**	**801**	**856**	**1,042**
Postdoctoral fellows					
Total	**325**	**303**	**229**	**248**	**310**

13 Includes 20 supervised in collaboration with Cooperative Research Centres over the 12-month period.
14 A student may be supervised or supervised and sponsored.
15 Includes 143 students fully sponsored and 294 students partially sponsored by CSIRO.
16 The total number of Postgraduate students as at 31 May 2018 was 1,042, including 11 supervised in collaboration with Cooperative Research Centres.

Programs supporting our leaders and staff

During 2017–18, our strategic focus was on partnering to expand our collaboration and global development offerings to complement the Leadership, Innovation and Customer curriculum available across CSIRO. We also focused on delivering more digitally enabled programs to reach more learners, including people at remote sites and with carer responsibilities. Highlights included a stronger Early Career Scientist capability via the CSIRO/UNSW Industry PhD Program and Post-Doctoral Fellowship initiatives; progress towards a CSIRO Aboriginal and Torres Strait Islander Cultural Awareness curriculum; and investment in greater Asia cultural competency.

This year we delivered a modest increase in program-based learning opportunities: 3,652 program-based days, up from 3,608 days in the previous year, consolidating the more significant year-on-year growth over the past five years. This was achieved alongside our deliberate focus on digital transformation, implementing a new Learning Management System (LMS) and Social Learning Platform (JAM) and the creation of new digitally enabled programs – the Ready to Lead and Project Leader On-Boarding programs.

Year to date participation has been lower in traditional eLearning (826 days less than last year), however, this does not include participation in the three eLearning modules released in June 2018: the refreshed Code of Conduct, appropriate provision of Financial Services through the CSIRO Innovation Fund and the Business Model Canvas.

A highlight of 2017–18 was recognition, via independent, external benchmarking undertaken by CEB/Gartner that confirmed CSIRO Leadership Programs are exceeding global standards for executive programs. Further, CSIRO staff survey results indicate a correlation between participation in two key programs, Leading Australia's Innovation Catalyst and Experienced Leader Program, and higher levels of engagement. Program alumni report they are more engaged, energised, enabled and aligned with CSIRO strategy than other leaders.

Inspiring Aboriginal and Torres Strait Islander students into STEM pathways

The Aboriginal Summer School for Excellence in Technology and Science (ASSETS) is a nine-day residential program for high-achieving Indigenous Year 10 students, which continues to support students through Years 11 and 12. ASSETS was first established in 1992 by the University of South Australia, and in 2014 the program was integrated into the Indigenous STEM Education Project, managed and implemented by CSIRO and funded by the BHP Billiton Foundation.

Since then, ASSETS has grown from a single summer school event catering to 28 students in 2014 to three separate summer school events in Townsville, Newcastle and Adelaide, catering to 105 students each year between 2015 and 2018. A total of 331 Aboriginal and Torres Strait Islander students have attended ASSETS.

A survey of students who attended ASSETS in 2016–17 found that completing the program increased student awareness of STEM career possibilities (up 33 per cent to 99 per cent), and resulted in students changing their career preference to a STEM career (up 33 per cent to nearly 82 per cent) and deciding to study STEM at university (up 21 per cent to nearly 85 per cent.

ASSETS is committed to providing ongoing support to students outside the residential school through the ASSETS leadership program, which includes keeping students informed of relevant events, dates and scholarship opportunities, as well as organising work placements.

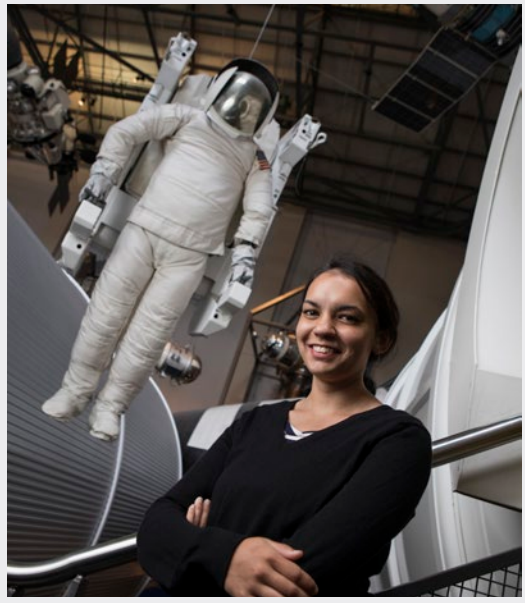
In 2017, Boeing Defence Australia partnered with the ASSETS program, offering week-long work placements at its Brisbane simulation, analysis and pilot training facility to four students. Kayla Pattel from Queensland's Tullawong State High School attended the ASSETS residential program in 2016 and was offered one of the Boeing placements in 2017. As part of her four-day placement, Kayla was involved in activities from building and coding a robot to piloting a simulation fast jet against computer-generated forces.

'The best part, in my opinion, was meeting the amazing and inspiring people that worked in all fields of Boeing, who took time out of their busy day to talk to us about what they do,' said Kayla.

Following the initial week-long placement, Kayla was invited back to Boeing to join a project for a further three weeks. At the 2017 Indigenous STEM Awards, Kayla and fellow 2016 ASSETS alumni Jessica Storrar were recognised with the Secondary Student Award. Kayla's work with Boeing was noted when she received her award.

Wayne Cawthorne from Townsville State High School also attended ASSETS in 2016. He completed two work placements with a postdoctoral research fellow at James Cook University, as well as placements at a medical office and an engineering firm, GHD Australia. In 2017, Wayne became one of three students to win the Queensland Government's Peter Doherty Outstanding Aboriginal and Torres Strait Islander Senior STEM Student Award. He is now enrolled in a Bachelor of Advanced Science at James Cook University and plans to work towards a Medical degree and eventually a job as a research scientist. Wayne's mum Maria said that attending ASSETS was the catalyst for his successful journey in STEM.

The Indigenous STEM Education Project is committed to increasing the participation of Aboriginal and Torres Strait Islander peoples in STEM education and careers. ASSETS is one of six program elements that make up the Project to target students through primary, secondary and tertiary education.



Kayla Pattel attended ASSETS in 2016 and went on to win the 2017 Indigenous STEM Secondary Student Award.

Activity 3:

Managing national research infrastructure

CSIRO research scientist and beetle curator Dr Adam Slipinski holds a weevil fossilised in amber at the Australian National Insect Collection.

CSIRO is responsible for managing National Research Infrastructure on behalf of the broader scientific community to help with the delivery of research. There are two types of National Research Infrastructure: National Research Facilities and National Biological Collections.

As the national provider of a range of specialised laboratories, scientific and testing equipment and other research facilities, CSIRO provides science-ready facilities for use by Australian and international researchers through application and user-funded arrangements related to the facility.

The National Research Facilities include the:

- Australian Animal Health Laboratory (AAHL), Geelong
- Australia Telescope National Facility (ATNF) comprising:
  - Parkes Radio Telescope, NSW
  - Australia Telescope Compact Array near Narrabri, NSW
  - Australian Square Kilometre Array Pathfinder (ASKAP) and the Murchison Radio-astronomy Observatory (MRO), WA
  - Mopra Telescope at Coonabarabran, NSW
- Marine National Facility (MNF), Hobart
- Pawsey Supercomputing Centre, Perth
- Atlas of Living Australia (ALA).

The National Research Collections Australia (NRCA) comprise:

- Australian National Fish Collection (ANFC) of marine fish
- Australian National Herbarium (ANH) of native plants and weeds
- Australian National Insect Collection (ANIC) of terrestrial invertebrates
- Australian National Wildlife Collection (ANWC) of terrestrial vertebrates
- Australian National Algae Culture Collection (ANACC) of living microalgae cultures
- Australian Tree Seed Centre (ATSC) supplying tree seed to both domestic and overseas customers.

TABLE 3.10: SUMMARY OF OUR PERFORMANCE FOR ACTIVITY 3

KPI AND METRIC	TARGET	RESULT	
Maintenance and operation of the research infrastructure to appropriate standards	Compliance with Australian legislation and regulations and ISO accreditations	G	Our research infrastructure achieved compliance with relevant Australian and international standards. AAHL continues to maintain or exceed the regulatory requirements certified by the Department of Agriculture and Water Resources, the Office of the Gene Technology Regulator and the Department of Health's Security Sensitive Biological Agents legislation, and all relevant ISO accreditation.
Utilisation of the facilities and collections as measured through: successful observations, time lost during observations, core hours used, outward loans and successful research days delivered	Minimum of 70% successful astronomy observations	G	The ATNF achieved 74.7% successful astronomy observations and lost 3.3% of time to unscheduled outages.
	Maximum 5% time lost during scheduled observation		
	90% core hours on Magnus supercomputer	G	92% core hours on Magnus were achieved.
	70% outward loans (over 5 years) – combined utilisation of national research collections	G	The NRCA achieved 70% outward loans. We also increased the proportion of the national biological collections that are digitised. The Australian National Algae Culture Collection maintained 100% digitisation.
	Minimum of 90% successful research days delivered on Marine National Facility	G	The MNF achieved 100% successful research days with no time lost during scheduled operations.
	Maximum of 10% time lost during scheduled Marine National Facility operations		
Utilisation of SIEF funded research infrastructure as measured through time allocations	>60% operational time used, 20% usage in collaborative projects	G	60% utilisation of operational time achieved for Research Infrastructure equipment that has been fully commissioned. Usage in collaborative projects is limited at this stage, but will increase as equipment is progressively installed and commissioned (please see the SIEF report on pages 147 and 149 for details).

Green shading indicates positive progress for the year and the target has been achieved.

Australian Animal Health Laboratory

Our national biocontainment laboratory

The Australian Animal Health Laboratory (AAHL) provides Australia's highest level of biocontainment within a purpose-built biosecurity infrastructure. AAHL is recognised nationally and internationally as a centre of excellence in disease diagnosis, research and policy advice in animal health and human diseases of animal origin. AAHL helps protect Australia's billion-dollar livestock and aquaculture industries, and the community, from exotic and emerging infectious diseases assisting to maintain Australia's economy, environment, and the health and social wellbeing of our nation. It is built and operated to safely store and enable work on the most dangerous pathogens and our experience developed in biosecurity and biosafety is sought by governments and customers around the world.

AAHL's infrastructure and scientific expertise enables it to deliver a vital service to the Department of Agriculture and Water Resources (DAWR) as Australia's Reference Laboratory for emerging animal diseases and high-consequence pathogens of animal origin. Over the past 30 years there has been a marked increase in the public health threat of emerging infectious diseases of animal origin, known as zoonoses, which has resulted in increased global demand for biocontainment laboratory space at PC3 and PC4.

AAHL is funded primarily by CSIRO appropriation. DAWR provides funding for an ongoing diagnostic service and the National Collaborative Research Infrastructure Strategy has provided funds to enable national and international researchers to access the facility. AAHL also delivers diagnostic and research services to Australian and state governments as well as to industry and international bodies. AAHL is recognised as a crucial part of Australia's biosecurity infrastructure.

AAHL's customer base has expanded through initiatives that deliver to local and international customers, while remaining true to the DAWR contract to provide a diagnostic, surveillance and response service to underpin Australia's licence to trade in animal products.

Services offered in 2017–18 included:

- access to high-containment laboratories and animal facilities for research
- collaborations with CSIRO Business Units to develop vaccines and therapeutics against dangerous pathogens
- research on vector-borne diseases such as Dengue and Zika viruses
- quarantine testing for horses, birds, aquatic species and companion animals
- training courses for vets in the diagnosis of animal diseases and biosafety training for scientists
- services that enhance regional biosecurity and food security across Asia.

Maintenance and operations

Maintaining and updating the microbiological and physical security of AAHL is an ongoing priority. Significant effort has been directed to upgrade the software used to plan, monitor and record maintenance activities at AAHL. Ongoing minor infrastructure works to replace end-of-life plant have included completion of stand-by boiler replacement, replacement of access control hardware, and design and tendering of pure water system and fire protection, and alarming systems for upgrade in 2018–19. Installation of dunk tanks to PC4 animal spaces was completed to satisfy regulatory requirements for transfer of material.

Planning is underway for a broader capital upgrade program as part of a third-of-life re-fit to ensure the facility continues to meet regulatory requirements of both the Commonwealth and State of Victoria. The business case for this was submitted in December and approved in the 2018 Federal Budget.

Each year, AAHL analyses samples from around 3,500 cases for diagnostic testing, including over 700 for rapid response emergency disease exclusion, covering 73 diseases. Other samples are received from around the world for a range of purposes, including to enable global movements of healthy animals, facilitate import of biological materials, exclude exotic diseases in Australian livestock or characterise viruses detected in our region. AAHL also plays a significant role in public health, testing for important zoonotic diseases. AAHL recently became the first animal health lab in Australia to gain accreditation under the Therapeutic Goods Administration's In-vitro diagnostic registration scheme, which regulates human testing.

3,500 cases tested, covering 73 diseases

To fulfil its role in emergency response, AAHL maintains and updates an Emergency Laboratory Response Plan. The template scenario for the plan is an outbreak of foot-and-mouth disease – a terrestrial animal disease.

Internationally, during 2017–18 AAHL staff contributed to policy advice and guideline setting through a range of World Organisation for Animal Health (OIE) and World Health Organization ad hoc groups, including those with a focus on bio-banking, aquatic and terrestrial disease diagnosis, response framework for zoonotic diseases and investigation of intentional use of biological agents. This latter area has also led to engagement with Departments of Defence and Foreign Affairs, and the United Nations. Support for laboratory capability development within the region has also expanded, with both the Food and Agricultural Organisation and OIE now supporting this program of work, which includes 22 laboratories across 16 countries.

Since 2014, AAHL has run an annual 'Recent Advances in Emergency Animal Diseases' symposium for veterinarians. In 2017, 104 vets attended this training event, which brought the total annual number of vets trained to 393. Other training activities included hands-on training in sampling and post mortem techniques, state-based training and internships. At the undergraduate level, AAHL has reached out to over 500 veterinary students every year since 2015 through a university engagement project.

Helping New Zealand manage a *Mycoplasma bovis* outbreak

The Australian Animal Health Laboratory plays an integral role in investigating exotic and emergency disease incidents in Australia and globally, with a strong commitment in the Asia-Pacific region.

Our staff are members and active participants in many significant international and national networks, including the International Animal Health Emergency Reserve (IAHER) arrangement. This arrangement permits signatory countries to share personnel in the event of an emergency animal disease outbreak to supplement their domestic emergency response capabilities.

In July 2017, the bacterial infection *Mycoplasma bovis* was found in cattle in the Oamaru area of New Zealand's South Island. Since then, the New Zealand Ministry for Primary Industries has been working hard to control the spread of the disease and, if possible, eradicate it from the country with support from local farmers, industry bodies and communities.

Mycoplasma bovis can cause a range of serious conditions in cattle including mastitis that doesn't respond to treatment, pneumonia, arthritis and late-term abortions, posing a risk to animal welfare and productivity. Fortunately, it does not infect humans and presents no food safety risk.

Although *Mycoplasma bovis* is widespread internationally and occurs in Australia, this is the first time it has been found in New Zealand. It is listed as an 'Unwanted Organism' under New Zealand's *Biosecurity Act 1993*, so when the organism was confirmed the New Zealand Government declared a biosecurity response. To eradicate the disease, it has approved $85 million for operational and compensation costs, while several industry bodies have committed an extra $11.2 million.

In August 2017, New Zealand activated the IAHER arrangement requesting assistance at its National Laboratory to manage the surge in testing as a result of the outbreak. The IAHER involves Australia, Canada, Ireland, New Zealand, the United Kingdom and the United States, but on this occasion, New Zealand decided to activate it with Australia only. This is the first time the arrangement has been 'activated' under the current agreement.

AAHL provided nine staff, including serologists and molecular biologists, for two weeks each between August and October 2017. Their assistance enabled New Zealand to cope with the surge in testing after the disease was initially detected as well as quickly identify infected properties, which has helped to rapidly manage and control the disease outbreak.

In a letter to Australia's Chief Veterinary Officer regarding Australia's support, New Zealand was very grateful for AAHL's prompt and professional response to its request for skilled resources to help with this emergency animal biosecurity issue. This outbreak has allowed for the IAHER arrangement and processes to undergo a real-world test for a medium-scale response.

AAHL's work in supporting other countries to control and eradicate infectious animal diseases reduces disease risk to these countries, but also helps to maintain Australia's biosecurity through better threat assessment and preparedness.

After an outbreak of *Mycoplasma bovis* in New Zealand, AAHL staff provided support with the surge in testing.

Australia Telescope National Facility

Australia's premier astronomy infrastructure

The Australia Telescope National Facility (ATNF) comprises world-class radio-astronomy facilities operated by CSIRO and associated instrumentation and research programs. ATNF observatories are located near the towns of Parkes, Narrabri and Coonabarabran in eastern NSW and in the mid-west region of Western Australia. In 2017–18, Australian Government funding supported merit-based access to the Australian Square Kilometre Array Pathfinder (ASKAP), the Australia Telescope Compact Array (ATCA) and the Parkes Radio Telescope.

Approximately 20 per cent of observing time on the Parkes Radio Telescope and all observing time on the Mopra telescope, near Coonabarabran in NSW, was funded by external partners. ATNF observatories also contain other instruments: the Murchison Radio-astronomy Observatory, home to ASKAP, also hosts the low-frequency Murchison Widefield Array (MWA) and is where an instrument of the international Square Kilometre Array will be built.

ATNF telescopes support galactic, extragalactic and cosmological research in fields as diverse as the interstellar medium, the formation and evolution of stars and galaxies, cosmic magnetism and understanding the extreme physics of pulsars and black holes.

ATNF comprises the major part of CSIRO Astronomy and Space Science, which also operates the Canberra Deep Space Communication Complex (CDSCC) on behalf of the US National Aeronautics and Space Administration (NASA). CDSCC is responsible for meeting the government's obligations under the US–Australia agreements for deep space tracking and communications in Australia. CSIRO, through the CDSCC, provides critical front-line mission control support to NASA for its deep space missions. CDSCC currently supports around 40 missions representing 27 nations worldwide that operate deep space telescopes and probes. CSIRO also manages Australian astronomers' access to these antennas, which are often used in conjunction with ATNF telescopes as part of the Long Baseline Array (LBA), an array linking radio telescopes in Australia and overseas.

Utilisation of the ATNF

Observing time on ATNF telescopes is awarded on the basis of scientific merit. New users of the Parkes telescope and the ATCA typically first observe from the Science Operations Centre at ATNF headquarters in Sydney, where they are provided with training and support. Once qualified, astronomers can operate these telescopes from their home institutions.

The full 36-antenna array of ASKAP was completed in November when the last of CSIRO's multi-award-winning phased array feed (PAF) receivers was installed. Commissioning of the receivers continued during the year with 24 currently online, available in two science sub-arrays.

Five Survey Science teams have been using ASKAP's Early Science imaging array of 12 antennas with over 1,000 hours of observations carried out to date. Several petabytes of data have been stored and are now being investigated. In parallel, a different subset of ASKAP antennas has been used in a highly successful search for fast radio bursts (FRBs). FRBs are a hot topic in astronomy – they are bright spikes of radio waves lasting a few milliseconds, but their cause is a mystery. The first FRB was discovered using the Parkes Radio Telescope in 2007 and only two dozen had been found since, until astronomers started finding them with ASKAP. It is hoped that ASKAP will be one of the first telescopes to pinpoint an FRB on the sky, which may lead to an understanding of their origins.

In 2017–18, research teams of 830 astronomers from 34 countries submitted proposals to use ATCA, Parkes and the LBA. For ASKAP, 10 major survey science projects, representing 363 investigators from 131 institutions, were selected to be allocated most observing time in the first five years of full operation. The Mopra telescope is no longer offered for merit-based access: observing time on Mopra is allocated to a consortium of universities that fund its operation.

Observers on ATNF telescopes other than ASKAP have 18 months after the observation during which they have sole access to their data. After this, the data are made publicly available to astronomers worldwide through CSIRO's public data archives. ASKAP data have no proprietary period and are released into the archive as soon as they have passed quality assurance checks.

Figures for 2017–18 include the merit-based allocation for ATCA and the Parkes Radio Telescope. Time allocated to observations rose slightly this year as less time was spent testing new receivers at the Parkes Radio Telescope.

TABLE 3.11: UTILISATION OF THE ATNF, IN %

	TARGET	2015–16	2016–17	2017–18
Successful astronomy observations (%)[17]	70 (min)	77.5	72.0	74.7
Time lost during scheduled observations (%)[18]	5 (max)	3.0	2.0	3.3

17 Success measures that observations were able to be completed. Encompasses all time allocated to astronomy observations, and allows for planned and unplanned non-availability e.g. maintenance, upgrades, weather events, etc.

18 Includes time lost through malfunction on fully operational facilities, but not commissioning time for new equipment or facilities.

Radio-quiet zone lets us see ‘cosmic’ dawn

The extreme ‘radio quietness’ of a CSIRO observatory has made possible a landmark discovery: a signal showing when the first stars burst into life.

A radio telescope can detect a radio signal a million billion times smaller than the ones a mobile phone can. That’s because, just as starlight is fainter than streetlights, cosmic radio signals are far fainter when they reach us than the radio waves from our technology. Mobile phones, radio stations and television transmitters use part of the radio spectrum and their signals can hide or overwhelm natural radio emission from the cosmos. Radio astronomers call these human-made radio waves ‘interference’.

CSIRO gave its new Australian SKA Pathfinder telescope (ASKAP) a head start in beating radio-frequency interference by establishing its home far from big cities. The Murchison Radio-astronomy Observatory (MRO) in Western Australia is 315 km from Geraldton. It lies in Murchison Shire, which is 49,500 square kilometres in size but home to just 100 people, so there are very few radio-emitting devices around. Strict on-site standards and procedures also help keep interference down and radio interference is further curbed by a legislated ‘radio-quiet zone’ around the observatory.

The value of these steps became clear in 2015 when early observations with ASKAP revealed a tiny signal from a galaxy five billion light-years away – a signal that started travelling before Earth formed. At many other sites such a signal would have been missed, blotted out by stronger human-made ones.

Now another radio telescope on the site has found a far tinier signal. In March, the Experiment to Detect the Global Epoch of Reionization Signature (EDGES) team, led by Dr Judd Bowman from Arizona State University, announced a stunning coup: they’d found evidence of the first stars in the universe lighting up, just 180 million years after the Big Bang. EDGES has been running for nine years at MRO, which Bowman and his team decided was the best place on the planet to do their work.

This is the first time astronomers have observed a signal from this early in the evolution of the universe.

Studying these signals is the key to understanding how the cosmos evolved. These primordial stars not only shaped the matter around them but, in particular, their explosive deaths created the soup of heavier elements, such as carbon and oxygen, from which later stars formed.

Other researchers are now seeking to repeat the detection. They will also seek to go beyond just a detection, eventually mapping where and when the first stars formed.

Doing this will need an extremely sensitive low-frequency array. The MRO will soon host such an instrument, SKA-LOW, the low-frequency telescope of the international Square Kilometre Array. SKA-LOW is due to start construction in the next few years.

The sign at the entrance to the Murchison Radio-astronomy Observatory, reminding visitors of the need to keep human-made radio waves, known as ‘interference’, to an absolute minimum.

Marine National Facility

Australia's world-class marine research capability

The Marine National Facility (MNF) is a key element of Australia's research infrastructure. MNF operates the research vessel *Investigator* to provide a world-class, blue-water research capability for Australian researchers and their international collaborators for work in Australia's vast and largely unexplored marine areas.

MNF includes the world-class research vessel *Investigator*, a suite of scientific equipment, staff to support delivery of research vessels and more than 30 years of marine data that are freely available.

Each *Investigator* voyage can cover 10,000 nautical miles

Investigator is a multi disciplinary research vessel capable of servicing the Australian marine science community for 300 days per year, for up to 60 days per voyage without re-supply. Each voyage is able to accommodate 40 scientists, technical staff and other participants and cover 10,000 nautical miles, with operational range from the Antarctic ice edge to the tropics. Onboard scientific facilities include multibeam seafloor mapping capability to 11,500 metres, deployment of oceanographic equipment to 7,000 metres and trawling to depths of 5,000 metres. In addition to onboard capabilities, *Investigator* has an extensive suite of scientific equipment, which can be added to voyages as required.

Access to the vessel is offered through two streams: MNF Granted Voyages (GV) and MNF User Funded Voyages (UFV). GV – the primary means of accessing ship time – are offered through a competitive, independent, peer-reviewed application process focused on scientific and technical excellence, the potential to contribute to Australia's national benefit and the ability of the research team. Sea time for GV is funded by the Australian Government with successful proponents responsible for meeting all other project costs. The UFV stream provides a mechanism for any unallocated sea time to be made available to research organisations and their collaborators under a charter arrangement.

MNF enables excellent scientific research in the national interest, providing key information to the broader scientific community, government, industry, policy makers and the Australian public. Research data support evidence-based decision-making on challenges affecting regional and global climate, fisheries management, geological resources, coastal and offshore developments, and marine operations.

Utilisation of the MNF

Several voyages undertaken this year highlighted both public interest and enhanced capability of *Investigator* and the science operations conducted on board:

- We launched the Floating Classrooms program as part of 2017 National Science Week. This program addresses one of MNF's five strategic pillars, student training, and aims to promote the use of the Facility. During selected port periods, *Investigator* makes on board laboratories accessible to secondary, tertiary and TAFE students for STEM studies.
- While transiting from Sydney to Broome, *Investigator* located the final resting place of the *SS Macumba* in the Arafura Sea off the coast of Arnhem Land. *Macumba* was a steel steamer sunk by the Japanese during World War II with the loss of three lives. Data collected by *Investigator* will help inform a detailed wreck inspection report and future management as a protected historic shipwreck.

- MNF initiated an Educator on Board program in September 2017, following a successful trial in January. It provides primary and secondary STEM teachers with an opportunity to help scientists with marine research; enhance their STEM content knowledge; run outreach activities, including live video broadcasts; and develop curriculum-linked resources to be trialled in their own classroom and shared with other teachers. The program aims to inspire STEM students and develop future generations of marine scientists. To date, nine teachers from across Australia have participated in this program.
- A voyage led by CSIRO during October and November studied the long-term impact of trawling on fish and seafloor species on the North West Shelf off Western Australia. This area was subjected to heavy trawling in the 1970s and 1980s by Australian fishers. The outcomes of this work will aim to inform fisheries policy and management for industry and government both within Australia and internationally. Significantly, this voyage was the first time *Investigator* had transited along the Western Australian coast, which completed the ship's circumnavigation of Australia.
- During January and February, CSIRO and the Bureau of Meteorology led a 42-day voyage to the Southern Ocean and Antarctic ice-edge to study the ocean and atmospheric conditions in the Southern Ocean and the impact these have on our climate. Eleven robotic Argo floats were deployed to continuously measure changes over the next 5 to 6 years 5,000 m below the ocean surface (measurements were previously only available to 2,000 m). The atmospheric component of this voyage included a combination of aircraft, ship-based and satellite observations to collect data on clouds and the interaction between incoming radiation, aerosol production and rainfall. The data collected during this voyage fill a significant gap in current data and will enable more accurate future climate projections.

TABLE 3.12: UTILISATION OF THE MNF, IN %

	TARGET	2017–18
Successful research days delivered (%)[19]	90 (min)	100
Time lost during scheduled operations (%)[20]	10 (max)	0

19 Successful research days from a possible 180 days (appropriation funded component), where success means the science was able to be completed consistent with the voyage objectives and allows for planned and unplanned non-availability e.g. maintenance, upgrades, weather events, etc.

20 Includes time lost through malfunction on fully operational facilities, but not commissioning time for new equipment or facilities.

Enabling globally significant research in our marine environment: North West Shelf trawling study

CSIRO delivers the Marine National Facility program for Australia. As part of this program, we own and operate the marine research vessel *Investigator*. The vessel houses a suite of multi disciplinary and cutting-edge scientific equipment, which enables us to collect high-quality, high-volume data to inform decision-making by government, industry and community.

Thanks to its technological capability, *Investigator* has made it feasible and affordable to address key challenges that face Australia's marine environment policy makers and resource managers. These challenges include the effects of trawling on the marine environment, particularly the seabed, which are a major issue for fisheries management globally due to a widespread lack of baseline and monitoring data. Such information gaps mean government is less able to set evidence-based policy and industry faces significant challenges in adopting effective practices to safeguard the sustainable management of fisheries.

In October and November 2017, CSIRO's Oceans and Atmosphere Business Unit led a 26-day research voyage on *Investigator* to study the long-term recovery of trawled marine communities on the North West Shelf off Western Australia. Forty researchers collaborated on the voyage from eight research institutions including Australia's WA Fisheries, University of Tasmania, Macquarie University and Museums Victoria, and China's Ningbo University and Chinese Academy of Sciences. This demonstrates the value of the Marine National Facility as an international collaboration hub for knowledge exchange between scientists and, importantly, between scientists and the public through the communication activities delivered during the voyage.

The *Investigator*'s significant capability and capacity allowed researchers to set and complete an ambitious program of deployments that delivered a record number of operations carried out on a single voyage. We deployed a wide range of equipment in 584 operations during the 26 days including demersal fish trawl net, epibenthic sled, deep-tow camera, Conductivity, Temperature, and Depth (CTD) sensors, sediment grab and plankton nets.

The voyage included four supplementary projects, which offered a significant additional benefit by delivering multidisciplinary science outcomes. These included detailed seafloor mapping of Ningaloo Commonwealth Marine Reserve, which has provided Parks Australia with data to better manage and conserve this high profile and globally significant marine environment.

In total, 100 individual stations were sampled during the voyage. The flexible platform offered by *Investigator*, combined with expertise of the Marine National Facility and ASP Ship Management technical support staff, enabled reliable data to be collected from nearly all stations. This demonstrates the value of the Facility in delivering highly efficient operations that enable significant volumes of data and samples to be collected, which can be accessed for future analysis and benefit of all.

The data obtained – approximately 4 terabytes – and samples collected will enable us to evaluate the recovery of benthic habitats and demersal fish assemblages 30 years after very significant reductions in trawl effort. The data will also help us to make comparisons with areas that have been trawled continuously over the same period. The ability to do this with access to comparative data collected during the 1980s is unprecedented – made possible as a result of this voyage.

This voyage will significantly improve our understanding of the long-term recovery of trawled marine habitats and the effectiveness of management responses to protect and enable recovery of impacted ecosystems. The results will be significant in an international context and relevant to the management of trawl fisheries in Australia and overseas.

***RV Investigator* enables vital surveys of our marine biodiversity.**

Pawsey Supercomputing Centre

A world-class high-performance supercomputing facility

The Pawsey Supercomputing Centre is one of only two high-performance computing facilities in Australia that enables researchers to tackle large-scale data problems and simulations. The Centre provides researchers in government, academia and industry access to world-class expertise and infrastructure in supercomputing, data and visualisation services, including access to one of the most powerful supercomputers in the Southern Hemisphere.

Pawsey currently serves over 80 organisations and is achieving unprecedented results in science domains including radio astronomy, geosciences, resources engineering, bioinformatics and health sciences. It also supports the Square Kilometre Array (SKA) Pathfinder research.

Pawsey is an unincorporated joint venture between CSIRO, Curtin University, Edith Cowan University, Murdoch University and the University of Western Australia. Its operations are governed by a Members' Agreement, with effective governance provided by a Board comprised of core member representatives, independent members and an independent chair.

CSIRO owns and operates the Centre's building, which is located at our Kensington site and offers a range of supercomputing and large-scale data facilities including Magnus (a petascale system) and data-storage capabilities in excess of 100 petabytes. It also houses Galaxy, a Cray XC30 dedicated to the operational requirements of the Australian precursor projects to the Square Kilometre Array (SKA): the Australian Square Kilometre Array Pathfinder (ASKAP), operated by a CSIRO facility, and the Murchison Widefield Array (MWA), run by Curtin University.

Pawsey is primarily funded by the Australian Government, the West Australian Government and Pawsey members. Pawsey previously employed staff from all five member organisations, however, since 1 July 2017 all staff have been employed through CSIRO. Pawsey currently has 43 staff members whose expertise enables Australian researchers to take advantage of the Centre's wide range of services.

Utilisation of Pawsey

Pawsey provides access to its supercomputing resources through several national and stakeholder merit allocation schemes. Schemes operating in 2017–18 were the:

- National Computational Merit Allocation Scheme – 25 per cent of resources allocated. The call for proposals was made in September/October, with 12-month allocations, budgeted quarterly
- Energy and Resources Merit Allocation Scheme – 15 per cent of resources allocated, with 12-month allocations, budgeted quarterly
- Pawsey Partner Merit Allocation Scheme – 30 per cent of resources allocated, with 12-month allocations, budgeted quarterly
- Pawsey Director's Allocation Scheme – 5 per cent of resources allocated. Responsive-mode grant assessment process, available most of the year and most resources were small (<0.1 per cent of available resource time), 3-month allocations
- Radio-astronomy Scheme – 25 per cent of Pawsey resources allocated (i.e. Galaxy).

The Centre supports over 1,500 researchers across Australia

The Centre supports over 1,500 researchers across Australia, a number which has increased by 30 per cent in the last two years. Demand has already exceeded availability: last year, the three major allocation schemes recorded an average of 47 per cent success rate (time allocated vs time requested). More than 550 million core hours were requested when only 270 million core hours were available.

TABLE 3.13: ALLOCATION OF THE MAGNUS SUPERCOMPUTER, IN %

	TARGET	2017–18
Core hours used on the Cray XC-40 supercomputer Magnus (%)	90	92

Pawsey helps protect Perth's water supplies

In Western Australia's capital city of Perth, where around 80 per cent of the state's 2.6 million people live, dams and rivers are all but redundant. Years of below-average rainfall have caused water supplies to dwindle, creating increasingly drier catchments. Consequently, the groundwater system is vital to meeting Perth's public and private water needs. Each year, the state government manages 400 gigalitres of groundwater from aquifers, making up 46 per cent of the total supply. With a growing population and climate change impacting on aquifer recharge, it is an increasing challenge to sustain these precious water resources.

With the help of Pawsey's flagship system, the Magnus Cray XC40 supercomputer, Professor Brett Harris and his team from Curtin University Department of Exploration Geophysics created detailed 3-D models of Perth's groundwater aquifers from the surface to more than 2 km below.

To map Perth's complex multi-level aquifer system, they collected data spanning thousands of square kilometres by sending airborne electromagnetic survey measurements directly to the powerful supercomputer for near-real-time data processing. With the sheer volume of data being sent back and forth, using Magnus was vital – turning a job estimated to take several years on a single computer processing unit into one that could be completed in a matter of hours.

The speed and power of Magnus allowed the team to spot errors on-the-go, test new ideas and build the 3-D maps as quickly as possible. The system also provided the capacity for the team to integrate data from multiple sources and accurately model the geology of the aquifers. Two hundred simulations had to be run on each survey reading to ensure accurate conversion to information about rock type and groundwater chemistry.

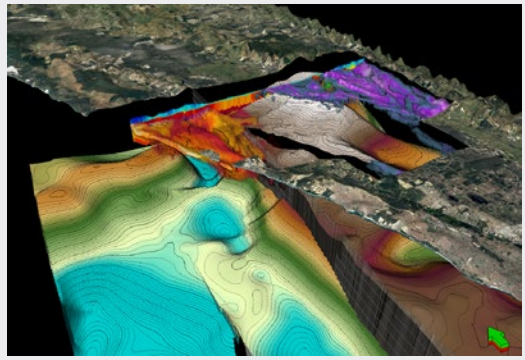
These maps are critical to support the government's plans for Water Corporation to add new extraction and replenishment wells on the Gnangara system, the largest groundwater source in Western Australia.

By increasing the understanding of how the different parts of the groundwater system are connected, and where and how water moves through the systems – especially from the superficial aquifer into the deeper aquifers – the government can identify locations and rates for taking groundwater that have less impact on the environment and other water users.

The research has already informed the Department of Water and Environmental Regulation to recommend replenishment and abstraction sites based on their ability to deliver goals of both maximum redraw and optimum environmental benefits, supporting groundwater levels near lakes, wetlands and areas of seawater intrusion risk.

Magnus will continue to supply the processing power required as the team writes code to automate the processing and integration of data from many sources, enabling electromagnetic readings to be instantly inverted to inform groundwater models. Ensuring an accurate framework from the beginning is crucial to support long-term forecasting over the next 50 to 100 years.

Groundwater replenishment is the 'dam building' of the 21st century. It is accepted in areas like Perth as a better storage option for harvested and recycled water and helps offset water losses from climate change, evaporation and water use.



Detailed 3-D models of Perth's groundwater aquifers, created using Pawsey's powerful supercomputer, are helping the Western Australian Government to protect and maintain the city's water supplies.

National Research Collections of Australia

Biodiversity science research infrastructure

Australia is home to more than half a million species of plants and animals. Three-quarters of these are found nowhere else on Earth. This unique biodiversity is a national treasure and is a crucial environmental asset, providing ecosystem services and economically valuable resources.

CSIRO is the custodian of several collections of animal and plant specimens that contribute to national and international biological knowledge. The National Research Collections of Australia (NRCA) are a vital resource for conservation, science and industry innovation. They provide a history of Australian fauna and flora. NRCA's six biological collections contain more than 15 million specimens, representing a 240-year time series of data on the occurrence and distribution of native and introduced plants, terrestrial vertebrates, insects, fish and algae.

These collections are Australia's most reliable set of nationally representative biological collections. They underpin research in agriculture, biosecurity, biodiversity and climate change and are used by researchers all over the world. The collections allow us to identify, quantify and explore Australia's biodiversity over time and also inform public policy decisions, support biosecurity and contribute to environmental management.

NRCA's role is to protect and explore the rich biological information in its collections to conserve and exploit unique biodiversity for the benefit of our environment, the community and industry. The Environomics Future Science Platform (FSP) is a research-intensive enterprise developing new ways to reveal and make use of genomic resources in nature. These novel technology 'platforms' will meet our customers' needs to gather more accurate environmental information at greater speed and accuracy than currently possible and support new business for CSIRO Business Units. The Environomics FSP is hosted by the National Research Collections and partnered with Oceans and Atmosphere, Land and Water, and Data61, as well as four universities and three National Collaborative Research Infrastructure Strategy (NCRIS) facilities.

The NCRIS-supported Atlas of Living Australia (ALA) is a world-leading informatics, visualisation and analytics platform that integrates Australian biological and environmental data from a wide variety of sources and makes them available to users online for education, research and policy development. The use of open source occurrence data to inform biological research, environmental management and conservation planning, education and community engagement is now widely accepted. In 2017–18, the ALA explored the addition of environmental DNA, or eDNA, data to its infrastructure, and helped to establish global standards and common practices for the management of DNA-derived data and the delivery of trait data.

Utilisation of the collections

This year, the Australian National Herbarium (ANH) contributed to national and global research through loans and exchanges with more than 41 herbaria in 18 countries. In addition, ANH developed a new classification system for Australian grasses based on awn morphology and is determining the origins of key agricultural weeds.

ANH was deeply involved in the Environomics FSP, where it used novel genomics approaches to quantify pollination services in alpine plant communities and developed a deeper understanding of plant biology, which will inform how it creates portable devices to study plants in the field.

More than 80 per cent of specimen records are digitised and available through Australia's Virtual Herbarium and the ALA. Imaging of newly accessioned ANH type specimens is continuing, with images now publicly available through the Global Plants Initiative hosted by the digital library JSTOR. In addition, a further 60,500 images of specimens from ANH's general collection have been captured. These images will be publicly available when the new Collections Management System is deployed.

In 2017–18, the Australian National Insect Collection (ANIC) hosted over 100 national and international researchers and provided 24 tours of the collection. Research by staff and affiliates on ANIC specimens resulted in the descriptions of 20 new genera and over 200 new species of insects. In addition, more than 7,000 specimens were loaned to 16 Australian institutions and 20 institutions overseas to support national and global taxonomic research.

Over 72,000 ANIC specimens were either primarily databased (from label data) or imaged and sent for transcription in DigiVol by the National Collections and Marine Infrastructure digitisation team. ANIC staff continued to act as trusted advisors in biosecurity for the Federal Government and will deliver a training course in insect preservation and identification for Northern Australian Quarantine Staff in early 2019. Two Department of Agriculture and Water Resources staff work as part of ANIC to identify hundreds of insects intercepted at Australia's borders each year.

The Australian National Wildlife Collection (ANWC), especially its cryo-frozen tissue collection, is a major research resource for the international community, with 553 samples sent for DNA sequence-based research during 2017– 18. ANWC digitised 1,255 specimens and 2,055 genetic samples. New material primarily involved bird specimens collected from south-eastern Western Australia.

The Australian National Algae Culture Collection (ANACC), through the Australian National Algae Supply Service (ANASS), provides microalgae strains as starter cultures to industry, research organisations and educational institutions in more than 70 countries, with a particularly strong customer base in Oceania, Africa and Asia. During 2017–18, ANASS managed 173 orders representing a total of 351 living microalgae cultures to 83 customers (66 per cent Australian and 34 per cent international). ANACC is working towards licencing a subset of strains for commercial exploitation. Core culture and accession information is digitised for all ANACC specimens, and most of these are publicly available through an online database. Additional imaging, geo-referencing, genomic and phenotypic characterisation have been digitised to different levels. Overall digitisation rates have remained the same as 2016–17.

The Australian Tree Seed Centre (ATSC) supplies wild and genetically improved native tree seeds to Australian and international customers.

During 2017–18, ATSC filled 99 seed orders (47 per cent Australian and 53 per cent international) to 78 customers. This year, ATSC focused on updating germination testing of older seedlots of long-lived species, including desert acacias and collection of eucalypt species native to the ACT and southern NSW.

The Australian National Fish Collection (ANFC) is one of CSIRO's most accessible collections due to the high proportion of digitised specimens that are publicly available through the ALA. These records include 151,000 fish specimens, 65,000 images of fishes, 11,000 x-rays, and 16,000 tissues for genetic analyses, representing marine species from Australia, the Antarctic and the Indo-Pacific region. In 2017–18, work focused on innovative methods for extracting high-quality genomic information from preserved specimens that represent snapshots of past levels of genetic diversity. This allows estimations of historical ecological parameters for important Australian fisheries.

The ALA holds close to 75 million records

The ALA is now established as biodiversity data delivery and integration infrastructure in seven countries around the world. Another 10 countries are currently investigating its use and including development funds in proposals. It is also the primary mechanism through which NRCA's digitised biological collection data is made freely available. A major refresh of the user interface has delivered new initiatives and data streams, e.g. trait and genomic data. The Atlas holds close to 75 million records provided by partnering with museums, state and local governments, non-government organisations, universities and CSIRO. As of 2017–18, approximately 15 billion records in total have been downloaded for uses in education, research and management.

TABLE 3.14: COMBINED UTILISATION OF NATIONAL RESEARCH COLLECTIONS, IN %[21]

	TARGET	2017–18
Outward loans (% over 5 years)	70%	70%

21 Excludes ATSC and ANACC because the function of these collections is a supply service, not coverage.

A daisy weed seed key to protect Australia's biosecurity and support trade

CSIRO is working to protect Australia's biosecurity by developing new tools for faster, more efficient border diagnostic services.

Each year, between 20 and 40 percent of crops are lost to plant pests and weeds globally. Weed infestations have a devastating impact on primary production and the natural environment and are estimated to cost Australia billions of dollars each year.

Many of the world's 25,000 species of daisies are aggressive weeds. Around 1,000 daisy species are native to Australia, but many others occur here as invasive weeds, including dandelions, cudweeds, thistles, bitou bush and fireweed. Daisies are especially effective weeds and the seeds of many species spread very easily on the wind.

Daisy seeds can accidentally enter Australia at our air and sea ports on cargo such as containers, cut flowers, machinery and cars. When daisy weed seeds are intercepted at our borders they need to be identified quickly and accurately. Are the seeds a new weed risk, a native species or a weed that is already established here? Does the shipment need to be put through an expensive and time-consuming cleaning process?

The seeds of weedy daisies can be difficult to identify. Around 40 per cent of seeds that are found during quarantine inspections belong to daisies. Before our weed seed key, around one in five of these seeds couldn't be accurately identified. Daisies can cost businesses money when their seeds delay shipments from entering the country.

The Australian National Herbarium in Canberra has a collection of expertly identified daisies, native species and weeds. Stored pressed on archival paper sheets, many of these specimens were collected during or after fruiting and contain seeds within the flower head. Using the Herbarium's collection, supplemented by loans from other institutions and visits to overseas herbaria, we created an interactive, visual key that enables the seeds of weedy daisies to be easily identified. After a recent update, the key includes 98 species of biosecurity importance.

Unlike traditional single-entry identification keys, our weed seed key[22] presents all relevant seed characteristics to the user, illustrated with diagrams and photos. This allows biosecurity officers to use whatever seed features they have found, even if part of the seed is missing.

The development of the key was an initiative of the ON program, Australia's sci-tech innovation accelerator. It was co-funded by CSIRO and the Department of Agriculture and Water Resources (DAWR). DAWR uses the seed key when quarantine inspectors at Australia's borders send daisy seed samples to be identified by DAWR's scientific support staff. The key helps stop new weeds becoming established in Australia and prevents existing weeds being strengthened by new genetic diversity.

Herbarium specimen of *Chrysanthemoides monilifera* subsp. *rotundata*, which is included in the daisy weed seed key.

22 The key is available online at http://keys.lucidcentral.org/keys/v3/daisy_fruit/

Activity 4:
Enterprise support

Opened in December 2017, the CSIRO Synergy Building forms the centrepiece of the Black Mountain Science and Innovation Park, and takes us one step closer to delivering the vision for a world-leading National Agricultural and Environmental Sciences Precinct.

TABLE 3.15: SUMMARY OF OUR PERFORMANCE FOR ACTIVITY 4

KPI AND METRIC	TARGET	RESULT	
Diversity and inclusion: Increase the number of shortlisted female applicants for leadership positions (CSOF 6-9)	>30% of shortlisted applicants for leadership positions are female	G	34% of shortlisted applicants for leadership positions were female, based on applications where gender identity was identified. The overall proportion of female leaders employed by CSIRO has increased by 1% from last year.
Morale: Staff engagement score as measured through the staff survey	78% of CSIRO staff are engaged with the organisation	G	The staff engagement score of 78%, as measured through the staff survey, has achieved the target and is a solid improvement from 75% recorded last year. This represents a continued positive trajectory for staff morale, trending well towards longer term targets.
Reputation: • Staff are proud to be associated with CSIRO as measured through the staff survey	82% of staff are proud to be associated with CSIRO	G	This year 90% of staff said they were proud to be associated with CSIRO, significantly exceeding the target and improving from the score of 84% recorded last year.
• Maintain or increase public perception of CSIRO as measured through a community survey	82% of survey participants are aware of CSIRO	G	The Australian community's perception and awareness of CSIRO is 89%, consistent with 2016–17 results.
Budget operating result: Meet or exceed bottom line operating result as approved by the Board	Achieved or exceeded	G	CSIRO achieved an operating result consistent with the approved budget, with a slightly positive variance of approximately 0.5% of the budget.
Staff safety: • Regulatory reportable Comcare incidents	No more than 9 Comcare incidents	G	There were 8 incidents reported to Comcare. None of the incidents resulted in serious injuries, but resulted in detailed investigations and a focus being placed on safety leadership within the organisation.
• % HSE audits and reviews actions completed on time	80% audits and review actions completed on time	G	91% of HSE audits and reviews actions were completed on time. The remaining actions are in progress towards completion.

Green shading indicates positive progress for the year and the target has been achieved.

Diversity and inclusion

The CSIRO 2020 Strategy and the People Strategy articulate our commitment to realising the innovation benefits derived from an inclusive workforce diverse in its background, thinking and experiences. CSIRO has addressed diversity and inclusion in its broadest forms over several years, with a targeted focus on gender, cultural diversity and Aboriginal and Torres Strait Islander peoples.

An important focus of improving diversity is on leadership positions, where the intention to improve the gender balance can be exhibited by an increased proportion of female candidates being shortlisted for appointment. During 2017–18, of the applicants where gender identity was available, more than 34 per cent were female. The overall proportion of female leaders employed by CSIRO increased to 32 per cent from 31 per cent last year. This represents a trajectory towards an actual improvement in the gender balance in CSIRO leadership.

This year, CSIRO expanded its participation in two key government-funded National Innovation Statement initiatives: the Science in Australia Gender Equity (SAGE) program, initiated by the Australian Academy of Science, and Male Champions of Change STEM.

The SAGE program provides an accreditation framework designed to improve gender equity and diversity in science, technology, engineering, mathematics and medicine via the pilot of the Athena SWAN Charter in Australia. Athena SWAN Awards offer Bronze, Silver and Gold levels in recognition of institutional capacity to eliminate gender inequity and a demonstrated commitment to bolster the employment, promotion and retention of women.

CSIRO applied on 29 March 2018 seeking an entry level Bronze Award. The CSIRO SAGE Action Plan 2018–2022 consists of 90 targeted actions to address the cultural, systemic and pipeline barriers to women's progression in STEM. The Action Plan aims to deliver benefits within CSIRO while also contributing to best practice solutions across STEM.

The Male Champions of Change STEM group was established in October 2016 in partnership with the Male Champions of Change Institute. Its primary purpose is to work together to achieve a significant and sustainable increase in the representation of women in leadership positions in STEM. In the first year, our Chief Executive Dr Larry Marshall engaged in seven focus groups within CSIRO to understand barriers to gender equality and generate bold action plans for change.

Since 1994, departments and agencies have reported on their performance as policy adviser, purchaser, employer, regulator and provider under the Commonwealth Disability Strategy. In 2007–08, reporting on the employer role was transferred to the Australian Public Service Commission's *State of the Service* report and the *APS Statistical Bulletin*. These reports are available at www.apsc.gov.au. From 2010–11, departments and agencies are no longer required to report on these functions.

The Commonwealth Disability Strategy has been overtaken by the National Disability Strategy 2010–2020, which sets out a 10-year national policy framework to improve the lives of people with disability, promote participation and create a more inclusive society. A high-level two-yearly report will track progress against each of the six outcome areas of the Strategy and present a picture of how people with disability are faring. The first of these reports is available at: https://www.dss.gov.au/our-responsibilities/disability-and-carers/publications-articles/policy-research/national-disability-strategy-2010-2020#05.

The percentage of CSIRO staff who recorded a disability as at 30 June 2018 was 4.1 per cent.

Indigenous engagement

We launched our first Reconciliation Action Plan (RAP) in late 2016, which builds on CSIRO's Indigenous Engagement Strategy. Achievements from the RAP are evident across several areas in partnerships, cultural awareness, employment, procurement and education. This year, Welcome to Country activities have increased at CSIRO events including the CSIRO Awards ceremony and launch of the Synergy building, and in carrying out an Acknowledgement of Traditional Owners at the beginning of meetings from the CSIRO Board and CSIRO Executive, to meetings in business and support areas.

The CSIRO Board, following the advice of CSIRO's Indigenous Strategic Advisory Council and Executive Team, endorsed CSIRO developing its next RAP for 2018. The new RAP has been drafted in accordance with Reconciliation Australia's RAP framework and with consultation across CSIRO from Business Units and Enterprise Services, the Aboriginal and Torres Strait Islander Staff Forum, and with guidance and advice from the CSIRO Indigenous Strategic Advisory Council (ISAC). The new RAP has been endorsed by the Executive Team and CSIRO Board and will be presented to Reconciliation Australia for its endorsement in July 2018.

In 2017–18, we developed a new Introduction to Aboriginal and Torres Strait Islander Cultural Awareness Framework spanning online, workshop and customised individual and team development initiatives. CSIRO's ISAC endorsed the Framework in March. Highlights this year included the development of the online program component of the Framework and piloting, in partnership with ISAC member Mr Phil Duncan, a Cultural Safety workshop for CSIRO leaders and staff.

CSIRO acknowledged National Reconciliation Week (27 May to 3 June 2018) with 18 events at CSIRO sites across Australia including events with guest speakers from local Traditional Owner communities, traditional foods, an art exhibition, an art interactive workshop, a flag raising and staff discussions about the Week's theme 'Don't keep History a Mystery' and CSIRO's Reconciliation Action Plan. For NAIDOC week in July 2017, CSIRO encouraged all staff to participate in local events and Aboriginal and Torres Strait Islander staff were able to use leave provisions to participate in cultural events.

CSIRO is tracking well against the Commonwealth Government's target for purchasing from Aboriginal and Torres Strait Islander-owned enterprises. In 2017–18, 1.6 per cent of CSIRO's contracts were awarded to Aboriginal and Torres Strait Islander-owned businesses, up from 1.3 per cent in 2016–17 and 0.2 per cent in 2015–16. The total value in the contracts awarded over this period increased from $2.7 million in 2015–16 to $22 million in 2017–18. Considered against CSIRO's total operating costs, expenditure with Aboriginal and Torres Strait Islander-owned businesses increased from 0.7 per cent in 2015–16 to 6 per cent of total operating costs in 2017–18.

CSIRO announced a new award in 2018 as part of the CSIRO Awards program. The Aboriginal and Torres Strait Islander Engagement Award recognises the achievements of CSIRO Officers in relation to Aboriginal and Torres Strait Islander engagement, participation, service delivery and research services.

Morale

Staff engagement is an overall measure of employee connection to their organisation and is closely correlated with productivity and performance. This year, we met our target of 78 per cent, compared to 75 per cent last year and 68 per cent in 2016.

CSIRO has rolled out a number of initiatives explicitly focused on building engagement with staff, including: ongoing senior leader-led initiatives (e.g. round tables, site visits); state-wide CSIRO Connect events in 2017 and 2018 to build a shared sense of purpose around our strategic direction, and ensuring that everyone feels included and valued. This year we have also implemented the organisational initiative Taking Action, which aims to transparently and collaboratively tackle major issues identified through staff feedback; and broader cultural actions to focus on transparency and accountability, greater inclusiveness, and building mutual trust with leaders.

Reputation

CSIRO has a reputation as a leading and respected institution in national and global innovation and as a trusted advisor. We assess our reputation through annual community surveys and an internal staff survey measuring staff pride, which provide us with the necessary insights to continue to play a key role in Australia's productivity and competitiveness.

Public awareness of CSIRO of 89 per cent is excellent and remains consistent with the past five years. Positive perceptions of CSIRO are also consistent, with 65 per cent of Australians viewing CSIRO positively.

A new Corporate Affairs strategy was approved in 2018. The strategy focuses on strengthening CSIRO's brand and creating more opportunities to connect with our community and customers. For example, in May we collaborated with Vivid Sydney to promote our data visualisation, health and biosecurity research. Our collaboration was promoted to millions internationally by Vivid Sydney, and our staff at our 'Beautiful and Dangerous' light activation interacted with over 7,000 people to promote the work of CSIRO.

CSIRO staff have always had a strong sense of pride in CSIRO and the role it plays in delivering high impact science to Australia. This is reflected in the score of 90 per cent of staff saying they are proud to be associated with CSIRO this year, an increase over the 84 per cent recorded last year and 80 per cent in 2016. In addition to the CSIRO Connect and Taking Action initiatives mentioned above, there are several other projects focused on work that will help to ensure the organisation remains a place where staff feel proud to work, such as defining our employee value proposition and the progressive SAGE initiative, which represents a major effort to build a diverse and inclusive culture where all employees can feel equally valued.

Budget operating result

In 2017–18 CSIRO delivered a deficit from ongoing operations of $59.8 million primarily due to unfunded depreciation expenses relating to assets for which capital was previously provided by the Government, consistent with expectations as outlined in CSIRO's Budget Statements. Externally earned revenue was $499.2 million (excluding the impact of any gains or losses on asset sales), which is a 3.1 per cent increase on the previous financial year. This outcome is more significant given 2017–18 was the first year for some time where CSIRO did not receive revenue from WLAN, which was received through a settlement process.

Since 2014–15, CSIRO has recognised strong growth in revenue from the Australian private sector industry (growth of 22 per cent) and the overseas entities and international sector (growth of 15 per cent), underlining the success of CSIRO's strategy in accessing new markets for Australian Innovation and creating deeper innovation relationships with our customers. Appropriations from government was $793.5 million, which is a record for CSIRO and reflects the important role that CSIRO plays in the innovation system. Total expenses for CSIRO were $1,352.5 million. All of these figures are materially consistent with approved budgets (see Table 3.16).

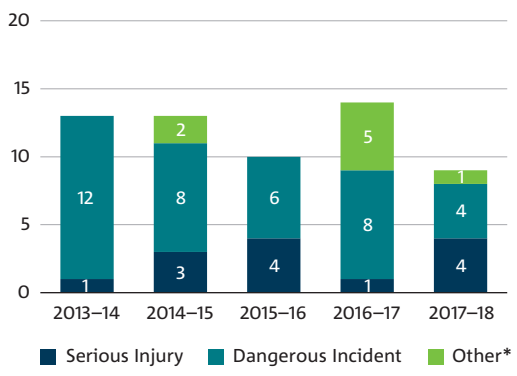
TABLE 3.16: CSIRO'S FINANCIAL PERFORMANCE BY SOURCE OF REVENUE, $M

REVENUE SOURCE	2013–14	2014–15	2015–16	2016–17	2017–18
Australian private sector	78.5	69.4	80.1	86.9	84.4
Australian governments	179.3	181.1	147.8	165.6	173.9
Rural Industries Research and Development Corporation	50.2	38.1	31.7	38.7	42.7
Cooperative Research Centres	14.7	9.5	10.0	12.0	9.1
Overseas entities and international	84.7	81.4	99.3	80.7	93.6
Work in progress/deferred revenue	–13.0	–6.1	–4.0	–9.3	–2.8
Total co-investment, consulting and services	**394.4**	**373.4**	**364.9**	**374.7**	**400.8**
Intellectual property (IP)—royalty and licence revenues	29.1	60.8	59.7	51.1	43.2
Total research and services revenue	**423.5**	**434.2**	**424.7**	**425.8**	**444.0**
Other external revenue	43.2	44.6	37.8	57.3	55.1
Gain/(loss) on sale of assets	-	0.0	1.2	0.9	0.1
Other fair value gains and reversals	-	6.7	-	-	-
Total external revenue	**466.7**	**485.5**	**463.7**	**484.0**	**499.2**
Revenue from government	778.2	745.3	750.3	787.3	793.5
Total revenue	**1,244.9**	**1,230.8**	**1,214.0**	**1,271.3**	**1,292.7**
Less expenses	1,270.6	1,245.3	1,261.8	1,292.1	1,352.5
Operating result	**–25.7**	**–14.5**	**–47.8**	**–20.8**	**–59.8**

Staff safety

In 2017–18, eight incidents (serious personnel injuries or high potential incidents) were reported to Comcare. One biosecurity incident was reported to the Department of Agriculture and Water Resources. None of these incidents resulted in serious injuries, however they were extremely serious and have resulted in detailed investigations and a focus on safety leadership within the organisation. Ninety-one per cent of reviews and actions arising from reportable incidents, or as a result of internal or external audits, were completed on time. The remaining actions are in progress, pending a restructure of the Health, Safety and Environment (HSE) function.

FIGURE 3.6: REGULATORY NOTIFIABLE INCIDENTS, 2013–14 TO 2017–18



*Biosecurity incident, reportable to the Department of Agriculture and Water Resources

In 2017–18, 34 staff suffered an injury serious enough to prevent them from coming to work, four more than 2016–17. These injuries occurred at a rate of 3.9 per million hours worked, which is an increase from the rate of 3.2 in 2016–17. These incidents are being fully investigated, but an initial review does not indicate a common contributing factor. In 2017–18, we had a significant decrease in injuries that required medical treatment. These combined reductions resulted in a 20 percent reduction in the Recordable Injury Frequency Rate in the financial year.

A key focus of our safety programs is to prevent injuries that have the potential to cause death or permanent disability. The top five enterprise risks in 2017–18, listed below, are addressed in our HSE strategic plan:

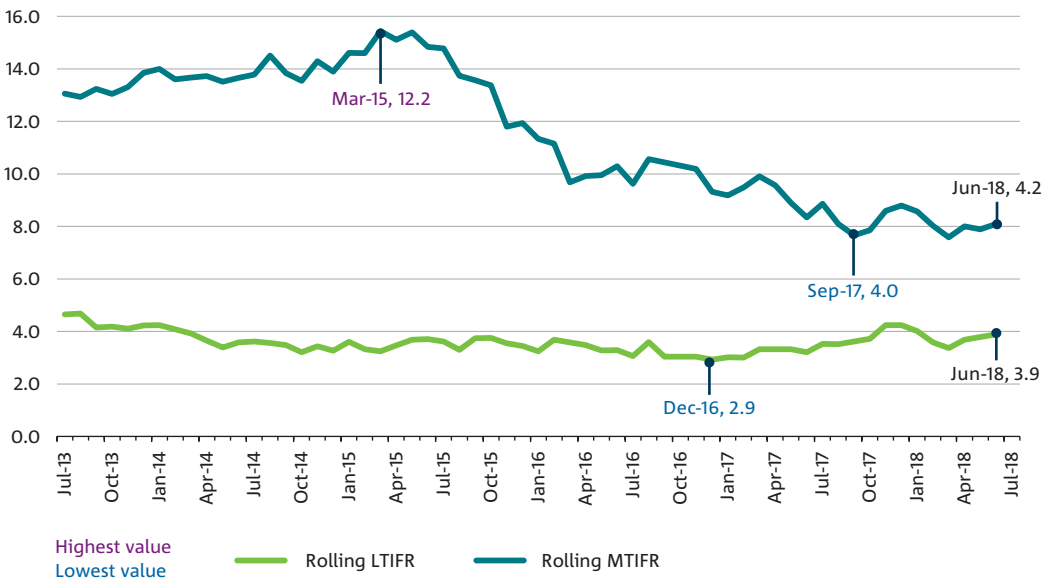
- Musculoskeletal injuries
- Plant and Equipment
- Psychosocial
- Travel (includes fieldwork)
- Chemicals and Gases.

In addition to the safety programs, we further developed a high-performance injury management team. This team achieved full compliance against the rehabilitation management system audit criteria in 2017–18 with only a small number of administrative improvements captured as observations. During this time, CSIRO also reduced its workers compensation premium by more than $1 million as a result of the early intervention efforts and dedicated rehabilitation support provided by this team.

In 2015–16, CSIRO's HSE 2020 Plan was developed to support CSIRO's strategy. In 2017–18, HSE staff worked with the Business Units and support staff to advance the programs and achieve cultural change by empowering staff to be safety leaders.

In 2017–18, an independent external HSE functional and capacity review identified the following areas of improvement: HSE Culture, Strategy and Leadership, Structure and Accountability, Capability and Capacity, and Systems and Processes. The review addressed both the HSE function and delivery of HSE outcomes across CSIRO more broadly. We are now implementing the review's recommendations.

FIGURE 3.7: CSIRO RECORDABLE INJURY FREQUENCY RATE FINANCIAL YEAR ROLLING 12-MONTHS[23], 2013–18



23 The Recordable Injury Frequency Rate is calculated as the sum of Lost Time Injuries per million hours worked (LTIFR) plus the Medical Treatment Injuries per million hours worked (MTIFR).

CSIRO launched a safety cultural change program to enhance the personal ownership of safety. HS-Me Day was undertaken across all CSIRO sites globally on 16 May (see page 17). The other key focus of HSE strategic projects is to make it easier for CSIRO team members to engage with HSE, build their skills and learn from past incidents. This includes continual review and improvement of the procedures and systems to ensure they are easier to use and understand.

Significant progress was also made in other key areas of the HSE 2020 Plan and these will be finalised in 2018–19. These include:

- further measures to make sure that researchers fully assess risks before undertaking potentially hazardous processes
- implementing the wellbeing framework.

Managing our environment

Reducing emissions and consumption

CSIRO has adopted government policy to reduce our emissions by 5 per cent by the end of June 2020 (compared to 1999–2000 levels). This aggressive carbon emission reduction target represents a 20 per cent reduction measured against business-as-usual projections. Electricity, gas and liquid fuel-related emissions (Scopes 1 and 2) account for approximately 38 per cent of CSIRO's total carbon footprint[24], with emissions embedded in CSIRO's supply chain (Scope 3) making up the other 62 per cent. To date, key focus areas have included:

- sustainable buildings and laboratory practices that lead to greater utilisation of facilities to meet future research and enterprise needs
- low-emission collaboration, including transport
- low-emission energy technologies
- understanding the impact of CSIRO's supply chain on our carbon footprint.

To achieve our research goals, CSIRO operates multiple types of facilities, such as laboratories, glasshouses, farm properties, supercomputers and telescope facilities, as well as managing plants and livestock. We also manage several nationally significant facilities on behalf of the Commonwealth Government, such as the high-security microbiological facility, Australian Animal Health Laboratory. These activities require significant quantities of energy and water, and produce waste.

Energy consumption (electricity and gas) dropped from 645[25] gigajoules (GJ) in 2016–17 to 630 GJ in 2017–18, a 2 per cent decrease. This includes CSIRO's use of electricity generated by on-site solar photovoltaic systems. The 2017–18 energy consumption is 2 per cent below the five-year average of 646 GJ per annum. Electricity consumption fell by 4 per cent, while gas consumption rose slightly (0.5 per cent) compared to the previous year. Our energy consumption continues to trend downward over the longer term, falling by 4 per cent over the last five years (see Table 3.17).

Factors that influenced our energy consumption in 2017–18 included:

- increased electricity and gas consumption at our Black Mountain site, attributed to the occupation of the new Synergy building, new glasshouse and heating of the Discovery building
- increased electricity and gas consumption at our Australian Animal Health Laboratory
- installation of 300 kW of photovoltaic cells at our Werribee site in December, which resulted in an 8 per cent reduction in electricity consumption at that site to the end of the financial year
- Relocation of staff from our Canberra City and Spring Hill sites and final disconnection of electricity and gas from our Highett and Belmont sites
- A range of sustainability initiatives undertaken across CSIRO.

24 Baynes, T., Saldanha, T., Malik, A., Haque, N., Schandl, H., Lenzen, M., "Carbon Footprint Report", 2015–16
25 Updated after new June 2017 data received.

CSIRO's carbon emissions due to electricity and gas consumption continue to fall, reducing by 5 per cent compared to the previous year and 11 per cent over the last five years (see Figure 3.8). CSIRO's electricity and gas-related emissions are 7 per cent below the five-year average. Electricity-related emissions fell by 6 per cent in the last 12 months, attributed to both reductions in consumption and changes in emission factors, offsetting a marginal rise in gas-related emissions.

11% reduction in carbon emissions over 5 years

CSIRO's mains water usage decreased by 10 per cent compared to the previous year, primarily due to the significant reduction in water consumption at Black Mountain, attributed to the completion of construction activities associated with the Synergy building and surrounds at the site. Mains water consumption in 2017–18 was 7 per cent below the five-year average of 347 ML.

CSIRO's air travel, based on kilometres flown, increased by 4 per cent in 2017–18 compared to the previous year and was 2 per cent above the five-year average. Approximately 55 percent of our air travel is undertaken internationally, which accounts for approximately 51 per cent of CSIRO's air-travel-related carbon emissions, based on preliminary calculations. Carbon emissions for international travel are general lower per kilometre compared to domestic travel due to less take-off and landing compared to short-haul flights.

FIGURE 3.8: CSIRO ENERGY AND WATER CONSUMPTION, AND GREENHOUSE GAS EMISSIONS (ELECTRICITY AND GAS ONLY)

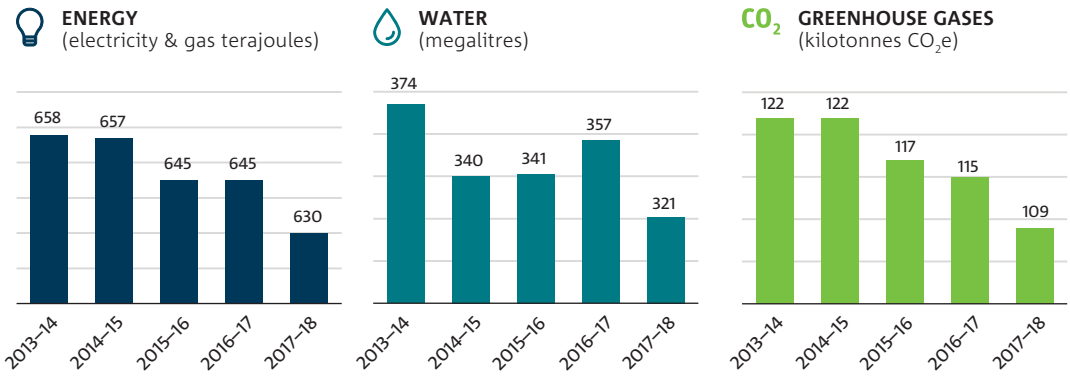


TABLE 3.17: CSIRO ENERGY, AIR TRAVEL AND WATER INTENSITIES

PERFORMANCE MEASURE	INDICATOR(S)	2013–14	2014–15	2015–16	2016–17	2017–18
Energy	Purchased energy (electricity and gas) consumed per employee (GJ/FTE)[26]	121	136	131	129[27]	121
Air travel	Million air kilometres travelled (km)	113	100	117	110	114
	Air travel per employee (km/FTE)	20,853	18,874	24,187	19,644	21,872
Relative mains water use	Amount of total water use per employee (kilolitres/FTE)	69	70	72	71	62

Sustainable facilities

CSIRO's site consolidation program in Canberra reached a key milestone when we handed over our new Synergy building at the Black Mountain Science Innovation Precinct in July 2017. Synergy is the largest building on the Black Mountain site at 16,000 m^2 and compromises purpose-built laboratory and office spaces. The building incorporates several environmental sustainability features including a mixed mode ventilation system, gas-boosted solar hot water, a thermal energy storage tank and rainwater harvesting for toilet flushing and landscape irrigation when required, and the ability to monitor and optimise the building operation through the building management system and network of submeters.

Our submetering program has been implemented across priority sites. The program enables us to capture and analyse electricity, gas and water consumption data from more than 500 meters in key energy-intensive buildings. The system provides automated, centralised and easily accessible energy and water data, which enables us to unlock efficiency gains through optimised building performance; monitor the effectiveness of energy-efficiency projects; investigate consumption-based tenancy agreements; and open up enhanced opportunities for scientific collaboration.

We have a mix of new and ageing buildings across our portfolio, including several heritage-listed buildings. As a result, realising carbon emission reduction opportunities can be challenging, particularly in older buildings, and these opportunities are often site or building specific. Building energy-efficiency programs are crucial to reduce the organisation's carbon emissions. An example is our lighting upgrade program, which continues to reap energy and cost benefits, reducing our carbon footprint by more than 100 tCO_2-e emissions in 2017–18. Energy costs have reduced by approximately $90,000 at our Pullenvale site due to a combination of lighting and other energy-efficiency initiatives. Additional lighting upgrades are in progress at our Clayton, Werribee and Hobart sites, which are expected to reduce emissions by approximately 500 tCO_2-e and annual electricity-related costs by more than $100,000.

CSIRO deployed Fault Detection and Diagnostic (FDD) tools to two more buildings at the Black Mountain site, and we continue to use the tool in our Phytotron building on the same site. Our ongoing use of the tool means we can continue to identify and realise significant energy reductions. For example, in 2017–18, the tool helped us to identify several faults in trial buildings, including a significant increase in energy consumption in one building, which we are investigating.

26 GJ/FTE is gigajoules per full-time equivalent (staff). FTE refers to CSIRO Officers as at June 2018.
27 Updated after new June 2017 data received.

In our Australian National Herbarium building, we reduced energy consumption by an average of 3 per cent by recommissioning the building, upgrading lighting and fume cupboard controls, and deploying the FDD tool.

Our enterprise-wide carbon reduction programs were complemented by the work of our state and territory property teams, who strategically upgraded control systems and cooling and heating equipment in our buildings. This has enabled intelligent load management and optimised building loads. The teams implemented optimisation initiatives in Werribee, Clayton, Black Mountain and Floreat, while our property team in South Australia installed a solar heating system, decommissioning the preheating Trace cable network. This has resulted in annual energy savings of 140 MWh and reduced emissions by 112 tCO_2-e.

Solar-powered science

CSIRO progressed towards our on-site renewable energy target of 5 megawatts (MW) by successfully installing a 300-kilowatt (kW) solar photovoltaic (PV) system at our Werribee site. The PV system generates approximately 15 per cent of the site's electricity requirements, reduces carbon emissions by 517 tCO_2-e per annum and saves on electricity costs.

Additional PV systems were installed at our Black Mountain site (142 kW) and Darwin site (99 kW), with installation of a 95-kW system in progress at CSIRO's Armidale site. The PV installations are the next steps in a large-scale multi-site rollout as we move closer to achieving our 5 MW renewable energy target by 2020 (currently, just over 1 MW of PV capacity is installed across multiple sites).

On-site PV installations at CSIRO's Waite, AAHL, Pullenvale, Clayton, Black Mountain and Narrabri sites are expected to begin within the next two years.

The 300-kilowatt solar photovoltaic system at our Werribee site comprises 1,000 solar panels.

Engaging with our staff

As part of our Sustainable Labs & Offices Program, we developed a unique tool for sharing sustainability tips: the Treading Lightly Virtual Tour. The Virtual Tour uses 360° panorama technology to showcase ways that staff can make sustainable choices when working in the office, laboratory or kitchenette, as well in meetings and organising events.

Built into the Virtual Tour was a Sustainable Choices Survey, which played a dual role: firstly it prompted staff to examine how environmentally friendly their workplace choices were, as well as capturing meaningful data about sustainability practices. The survey also asked staff to submit a pledge to make one 'green change' in 2018. Staff submitted a wide variety of pledges ranging from the simple 'I will compost all my tea from now on' to the more ambitious 'I will ride to work every day of the week'.

The successful completion of CSIRO's submetering program also enabled us to develop a Live Energy Dashboard, trialled at CSIRO's Black Mountain site as part of the new Synergy Building opening. The dashboard offers an engaging snapshot of live electricity data for five key buildings, including electricity intensity comparisons and consumption trends during the day. The project aims to educate staff about the energy used and costs required to power science. Monitoring of Synergy building data via the dashboard also provided rapid visualisation of electricity consumption patterns associated with the mixed mode ventilation system. As a result, the system was fine-tuned to remove large electricity demand spikes.

Waste and recycling

CSIRO actively manages around 30 waste and recycling categories through our national waste and recycling contract. From June 2017 to May 2018, CSIRO diverted over 11,600 cubic metres (weighing 1,600 tonnes) of waste from landfill, equating to a 38 per cent diversion rate by volume or 46 per cent by weight, which is slightly below our 50 per cent diversion from landfill target. Diverting waste from landfill resulted in avoided emissions of 1,080 tCO_2-e between June 2017 and May 2018.

Contribution to ecologically sustainable development

CSIRO upholds the principles of ecologically sustainable development (ESD) outlined in the *Environment Protection and Biodiversity Conservation Act 1999* through our operations and research activities. Table 3.18 provides examples of how we support the principles.

Managing our heritage

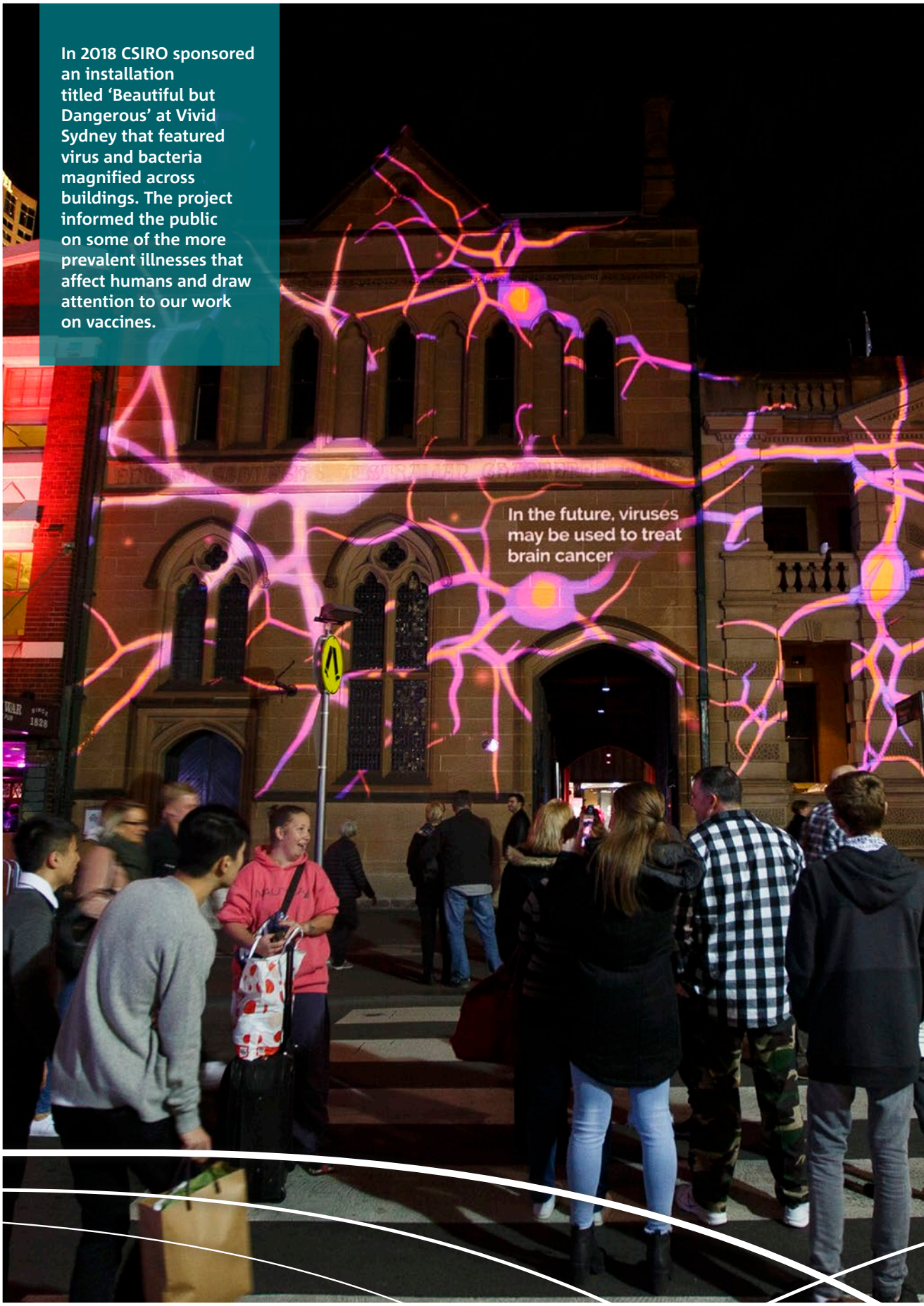
We recognise our responsibility to protect and conserve the Commonwealth and national heritage values of the places we own or control, and we manage these values according to the requirements of the *Environmental Protection and Biodiversity Conservation Act 1999*. Our Heritage Strategy for CSIRO Land and Buildings 2016–2026[28] outlines our objectives and responsibilities for the management of heritage values and has been endorsed by the Australian Heritage Commission.

In 2017–18, the Heritage Management Plans for the CSIRO Yarralumla and CSIRO Black Mountain sites were endorsed by the Australian Heritage Council. These Plans, and plans other Commonwealth heritage-listed sites, can be found at https://www.csiro.au/en/About/Strategy-structure/Heritage-management/Heritage-land-and-buildings.

28 The Heritage Strategy, along with a list of CSIRO land or buildings with Commonwealth heritage values, is available at www.csiro.au/en/About/Strategy-structure/Heritage-management.

TABLE 3.18: EXAMPLES OF CSIRO'S CONTRIBUTION TO ESD PRINCIPLES

PRINCIPLES	CSIRO'S ACTIVITIES
Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.	Under our planning and performance framework, CSIRO has adopted impact evaluations (conducted annually) and Business Unit reviews (conducted every 3 to 4 years) to assess the environmental, economic and social outcomes from our work. These assessments feed into a continuous improvement and evidence-based decision-making process to support the organisation's future science directions and investments.
If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	Development of Australia's coal and coal seam gas resources creates a significant challenge to provide the nation's decision makers with transparent scientific information about the potential cumulative impacts of coal resource development. In conjunction with the Bureau of Meteorology and Geoscience Australia, CSIRO undertook the Bioregional Assessment Programme. It provided integrated, regional-scale assessments of the cumulative impacts of resource development to inform the government's approach to managing the environmental impacts of anticipated coal and coal seam gas development. The approach taken in Bioregional Assessments to examine the potential impacts of the extraction of shale and tight gas was built on by the Australian Government's Geological and Bioregional Assessments programme, which began in 2018.
The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	CSIRO, in partnership with Victorian firm Lifecycles, Australian Oilseeds Federation and the Australian Export Grains Innovation Centre, undertook a life cycle assessment of the environmental impacts of Australia's canola industry to meet strict compliance requirements for access to EU markets. The assessment, accepted by the European Commission, successfully validated the sustainability of our canola industry, thereby securing access for Australian farmers and exporters to this valuable market. As other industries are called on to meet similar requirements, CSIRO's capabilities are available to help Australia's agricultural sector to assess environmental impacts and certify compliance with global responsibilities.
The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.	A voyage led by CSIRO during October and November 2017 studied the long-term impact of trawling on fish and seafloor species on the North West Shelf off Western Australia. This area was subjected to heavy trawling in the 1970s and 1980s by Australian fishers. The data obtained and samples collected will enable the evaluation of recovery of benthic habitats and demersal fish assemblages 30 years after very significant reductions in trawl effort and enable a comparison with areas that have been trawled continuously over that period. The ability to do this with access to comparative data collected during the 1980s is unprecedented. This voyage will significantly improve our understanding of the long-term recovery of trawled marine habitats and of the effectiveness of management responses in both protecting and enabling recovery of impacted ecosystems. The results will be significant in an international context, as well as relevant to the management of trawl fisheries both in Australia and overseas.
Improved valuation, pricing and incentive mechanisms should be promoted.	In 2017–18, CSIRO delivered two in a series of six Industry Roadmaps, each aligned to the Federal Government's Industry Growth Centres. The Food and Agribusiness Roadmap and the Oil and Gas Roadmap identify major growth opportunities for Australia and what the sectors need to do to achieve them. These roadmaps are an important step in working with Australian industry to understand current and future technology, market and consumer trends.



In 2018 CSIRO sponsored an installation titled 'Beautiful but Dangerous' at Vivid Sydney that featured virus and bacteria magnified across buildings. The project informed the public on some of the more prevalent illnesses that affect humans and draw attention to our work on vaccines.

Part 4
Management and accountability

Government engagement

Throughout 2017–18, CSIRO staff had regular meetings with ministers, parliamentarians and senior staff from relevant government departments to discuss their needs, share research activities and provide scientific information. They also received advice to inform policy development and program implementation and evaluation. We made seven submissions to parliamentary inquiries and our staff attended 10 inquiry hearings to provide information.

Legislation and government policy

CSIRO is 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 research workers, publishing research results, 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, CSIRO has notified its Minister and the Minister for Finance of three instances of significant non-compliance with the finance law (consisting of the PGPA Act, any rules pursuant to the PGPA Act, any instrument under the PGPA Act and any Appropriation Act) in the 2017–2018 period:

- The use by a former CSIRO employee of their CSIRO credit card for personal purposes and the processing of invoices for personal purposes through CSIRO's finance system. This matter was referred to the Australian Federal Police in July 2017. In response, CSIRO has reviewed its purchasing processes, is implementing improvements to its controls and processes and has provided additional training to all staff.
- A former CSIRO employee used CSIRO IT equipment for an improper purpose. The issue was identified immediately by CSIRO and stopped before any harm was caused to the organisation.
- CSIRO identified multiple instances of failure to supply to its Minister, as required by section 72 of the PGPA Act, information with respect to company activities. CSIRO has taken steps to ensure that all relevant line areas within CSIRO are aware of the ongoing requirements of section 72 and implemented additional reporting processes to ensure compliance in future.

CSIRO also provides administrative support services to the Trustee of the Science and Industry Endowmen Fund consistent with the *Science and Industry Endowment Act 1926*. The Fund has its own governance structure (see pages 144-159 for more information on the Fund).

There were no government policy orders to CSIRO during 2017–18.

Responsible Minister

As at 30 June 2018, the responsible Minister for CSIRO was Senator the Hon Michaelia Cash, Minister for Jobs and Innovation. Senator the Hon Arthur Sinodinos AO, Minister for Industry, Innovation and Science, was responsible Minister for CSIRO from 1 July 2016 to 20 December 2017.

Senator the Hon Michaelia Cash, Minister for Jobs and Innovation

Under the SIR Act, the Minister has power to:

- add to the purposes for which CSIRO may carry out scientific research (SIR Act, section 9(1)(a)(iv))
- 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 the Organisation (SIR Act, section 13).

The Minister provides CSIRO with a Statement of Expectations and the Board responds with a Statement of Intent. The latest Statement of Expectations was provided by then Minister Hunt on 18 November 2016. CSIRO's responding Statement of Intent was provided to then Minister Sinodinos on 1 May 2017.

These documents are available at www.csiro.au/en/About/Leadership-governance/Minister-and-Board/Statement-of-Expectations.

Ministerial directions and notifications

On 15 July 2014, the Minister directed the CSIRO Board to apply the Australian Government Public Sector Workplace Bargaining Policy to Enterprise Bargaining Agreement negotiations in CSIRO. During 2017–18, CSIRO kept the Minister for Jobs and Innovation and the Minister for Finance informed of the activities of CSIRO through our Board and in accordance with section 19 of the PGPA Act.

Governance

CSIRO Board

CSIRO is governed by a Board[29], which is responsible to the Australian Government for the overall strategy, governance and performance of our organisation.

The Board comprises nine part-time, non-executive members including the Chairman, and a full-time Chief Executive. At June 2018, there was one vacancy on the Board. All non-executive members are appointed by the Governor-General. The Chief Executive is appointed by the CSIRO Board, in consultation with the Minister.

In 2017–18, our Board operated in part through three standing committees and one sub-committee:

- Board Audit and Risk Committee
- Board People, Health and Safety Committee
- Board Science Excellence Committee
- Board Innovation Fund Sub-Committee.

On appointment, Board members receive a formal induction on the organisation and their duties. Members maintain their professional development and participate in visits to CSIRO sites as well as governance and business briefings. In the pursuit of their duties, Board members may seek independent professional advice and have access to CSIRO senior management.

Under its Charter and Operating Guidelines, the CSIRO Board reviews its performance, composition and skill base at regular intervals to ensure it is operating efficiently, effectively and with regard for the principles of good corporate governance. A review of Board performance is usually conducted at least every 18 months, with the next review to be undertaken in 2019.

Details of Board members, including qualifications and terms of appointment, are below. Details of remuneration, and attendance at meetings are shown in the financial statements (Part 5).

Board membership

From L to R: Prof Edwina Cornish AO; Dr Peter Riddles; Dr Larry Marshall; Prof Tanya Monro; Mr David Thodey AO, CSIRO Board Chairman; Mr David Knox; Ms Shirley In't Veld, Deputy Chair; Mr Hutch Ranck; Dr Michele Allan; Mr Drew Clarke AO.

29 The Board Charter and other details are at: https://www.csiro.au/en/About/Leadership-governance/Minister-and-Board

Board qualifications and experience

Prof Edwina Cornish AO: BSc (Hons) PhD FTSE AICD (26 November 2015 to 25 November 2020)

Professor Edwina Cornish AO brings vast experience in the interface between government, research, science and the higher education sector, and is an experienced board member with 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 successfully commercialised the world's first genetically modified flowers under her leadership. In 2014 she was made an Officer of the Order of Australia, in part for her advances in biotechnology and horticultural genetic modification.

Dr Peter Riddles: BSc (Hons), PhD, Grad Dip Bus FAICD, Company Director (24 April 2014 to 23 April 2017; 24 April 17 to 23 April 2022)

Dr Riddles began his career as a research scientist in molecular biology holding positions at the University of Queensland, Stanford University and the CSIRO. Since then, he has provided leadership to diverse organisations including biotechnology start-up companies, industry organisations, and University Commercial Offices. His current priorities include working with clinical entrepreneurs in enterprise creation and maintaining an interest in innovation policy and practice. He is a Fellow of the Royal Society for Arts (FRSA) (UK), a Member of Chatham House (UK), and a Fellow of the California Technology Council (CA, USA). Other current roles include Member of the Science and Industry Endowment Fund (SIEF) in Australia, Director of The Hear and Say Centre for Deaf Children (Brisbane, Australia), Advisor to digital health start-up BetterBySport (Bern, Switzerland) and Member of the Council of Reference to Academic Health Solutions (London, UK).

Dr Larry Marshall: BSc (Hons) PhD GAICD FTSE (1 January 2015 to 31 December 2016; 1 January 2017 to 30 June 2020)

Dr Marshall is a scientist, technology innovator and business leader with more than 25 years' experience in creating new value and impact with science. Dr Marshall has more than 100 peer reviewed publications and conference papers, holds 20 patents, has founded six successful United States companies in biotechnology, photonics, telecommunications and semiconductors, and has served on 20 boards of high tech companies operating in the US, Australia and China.

Prof Tanya Monro: BSc (Hons) PhD FAA FTSE FOSA FAIP GAICD, Company Director (25 February 2016 to 24 February 2021)

Professor Tanya Monro is Deputy Vice Chancellor: Research and Innovation and ARC Georgina Sweet Laureate Fellow, University of South Australia. She received a Royal Society University Research Fellowship, University of Southampton, was the Inaugural Director: Institute for Photonics and Advanced Sensing, and the ARC Centre of Excellence for Nanoscale BioPhotonics, University of Adelaide. Awards include: Eureka Prize for Excellence in Interdisciplinary Scientific Research, the Bragg Gold Medal (best Physics PhD in Australia), South Australia's "Australian of the Year", Scopus Young Researcher of the Year, South Australian Scientist of the Year, and the Prime Minister's Malcolm McIntosh Prize for Physical Scientist of the Year. Tanya is Fellow of the Australian Academy of Science (AAS), the Australian Academy of Technological Sciences and Engineering (ATSE). She is a board member on the Prime Minister's Commonwealth Science Council, the AAS National Committee for Physics and the South Australian Economic Development Board

Mr David Thodey AO: BA FAICD, Company Director (15 October 2015 to 14 October 2020)

Mr Thodey was the CEO of Telstra from May 2009 to April 2015, and prior to that had a 22-year career with IBM, working in senior marketing and sales positions, including CEO of IBM Australia/New Zealand. He is the Chair of Jobs for NSW Fund and Special Advisor to Square Peg Capital. Former board memberships include co-chair of the Infrastructure and Investment Taskforce of the B20 leadership group, and Chairman of IBM ANZ, TelstraClear, Information Technology (IT) Skills Hub, Industry Groups and Basketball Australia.

Mr David Knox: BSc (Hons) Mech Eng MBA FIE Aust FTSE GAICD, Company Director (5 May 2016 to 4 May 2019)

David Knox is an oil and gas industry executive and former Chief Executive Officer and Managing Director of Santos Limited from 2008 -2015. David was previously Managing Director for BP Developments in Australasia from 2003 to 2007. He has worked for BP in the United Kingdom and Pakistan, and has held management and engineering positions at ARCO and Shell in the USA, Netherlands, the United Kingdom and Norway. David is originally from Edinburgh, Scotland and has a BSc Hons in Mechanical Engineering and an MBA. He is a fellow of ATSE, and FIEAust and a graduate of the AICD. David is a Director of Migration Council Australia and a Member of the Commonwealth Science Council and the Royal Institution of Australia Council. David also sits on the boards of the Adelaide Botanic Gardens and State Herbarium and the Adelaide Festival.

Ms Shirley In't Veld: BCom LLB FAICD, Company Director (28 June 2012 to 27 June 2015; 28 June 2015 to 27 June 2020)

Ms Shirley In't Veld is a Non-Executive Director of DUET Group & Juniper Uniting Church Community. She is Chairperson of the Sustainability Committee of Asciano, and is a Council member of the Australian Institute of Company Directors (WA) and the SMART Infrastructure Facility (University of Wollongong). She is also a member of the CSIRO Energy Strategic Advisory Committee, Member of the Board of Perth Airport, a Panel Member of the Renewable Energy Target (RET) Review and Chairman of the Queensland Government, Electricity Expert Panel.

Mr Hutch Ranck: BSc Economics FAICD, Company Director (1 May 2011 to 30 April 2016; 5 May 2016 to 4 May 2018) – Term now completed

Mr Hutch Ranck has over three decades of diverse business experience both as a senior executive and as a board member. He is currently the Chairman of Elders Limited, a Director of Innotegic Pty Ltd and Iluka Resources.

Dr Michele Allan: BAppSc MMgtTec MCommLaw DBA FAICD, Company Director (5 May 2016 to 4 May 2019)

Dr Michele Allan is a food industry and agribusiness specialist who has held senior executive and director positions in the food and education sectors, and has an academic background in biomedical science, management and law. Dr Allan is the current Chair of the Board of Meat and Livestock Australia, Charles Sturt University,Apple and Pear Australia and Grains and Legumes Nutrition Council. Her current board positions include Innovation and Science Australia, Food and Agribusiness Growth Centre, Grain Growers Limited, Nuffield Australia and is a member of the Cooperative Research Centres Advisory Committee.

Mr Drew Clarke AO: PSM BAppSc (Surveying) MSc GAICD FTSE, Company Director (24 August 2017 to 23 August 2022)

Mr Clarke has served for more than 20 years in senior roles in the Australian Public Service, including as Secretary of the Department of Resources, Energy and Tourism, and Secretary of the Department of Communications. His last executive role was as Chief of Staff in the Office of the Prime Minister. In 2009 Mr Clarke was awarded a Public Service Medal for his energy policy work, and in 2016 was appointed an Officer in the Order of Australia for distinguished service to public administration. Mr Clarke is Chairman of the Australian Energy Market Operator Board and a director on the NBNCo Board. He has been an ex officio member of the Industry Research and Development Board (as Executive General Manager of AusIndustry), Chair of ANZLIC – the Spatial Information Council, Chair of the COAG Energy Council Standing Committee of Officials, a Director of the Cooperative Research Centre for Spatial Information and a member of the International Energy Agency Governing Board.

CSIRO Executive Management

The Chief Executive conducts the affairs of the organisation in accordance with CSIRO's strategy, plans and policies approved by the Board as well as the Board Directions to the Chief Executive.

Our Chief Executive is supported by our Executive Team (ET). As a team and through their individual roles, the members lead, direct, coordinate and control CSIRO's operations and performance.

This year we restructured our ET to more directly connect to our people and science. The Deputy Chief Executive role ceased to exist following the departure of its incumbent. Two new Executive Director roles were created. The Executive Director People will focus on growing our talent, building strong internal succession, and equipping our people to navigate a rapidly changing world.

The Executive Director Growth will lead business development and commercialisation, more directly connecting leaders to the opportunities and challenges for our business model. Data61's CEO joined the team to build on CSIRO's unique 'digital plus industry' expertise.

This year, and in accordance with the Executive Team Charter, the ET developed the Corporate Plan 2018–19 and Budget. The ET is assisted by two standing committees:

- The Science, Strategy, Investment and Impact Committee (SICOM) supports the ET to direct and control the organisation's strategic science, capability, investment and impact planning.
- The Major Transactions Committee (MTC) provides governance oversight on CSIRO's involvement in major transactions, and related matters and investments.

From L to R:
Dr Peter Mayfield: Executive Director Environment, Energy and Resources, BE (Hons) PhD
Dr David Williams: Executive Director Digital, National Facilities and Collections, BSc (Hons) PhD
Dr John Manners (ex-Officio): Director CSIRO Agriculture and Food, BSc (Hons) PhD Director
Ms Hazel Bennett: Chief Operating Officer, BSc (Hons) ACA FCPA GAICD FAIM (until 29 June 2018)
Dr Larry Marshall: Chief Executive, BSc (Hons) PhD GAICD FTSE
Dr Anita Hill: Chief Scientist and Executive Director Future Industries, BEng (Hons) MSc PhD FTSE GAICD
Mr Craig Roy: Deputy Chief Executive, BSc MSc MBA FAICD (until 1 April 2018)

Absent:
Mr Trevor Heldt: Executive Director People, BA CPHR (acting, from 2 April 2018)
Mr Adrian Turner (ex-Officio): CEO Data61
Mr Nigel Warren: Executive Director Growth, BIB MAICD (acting, from 2 April 2018)

During 2017–18, SICOM met in session four times. The MTC held 28 meetings, including six out-of-session meetings. Our CSIRO Leadership Team of senior managers provides a forum for sharing and discussing issues relating to the management and future strategy for CSIRO.

Remuneration of Executives and staff earning above $200,001 per annum

From 2016–17, CSIRO, along with other Australian Government agencies, is providing greater transparency of senior executive and staff earnings above $200,001 per annum. The following tables outline annual reportable remuneration including gross payments, reportable fringe benefits, reportable employer superannuation, allowances, bonuses and at-risk salary components.

TABLE 4.1: AVERAGE ANNUAL REPORTABLE REMUNERATION PAID TO SUBSTANTIVE EXECUTIVES IN 2017–18

TOTAL REMUNERATION	EXECUTIVES (NO)	AVERAGE REPORTABLE SALARY ($)	AVERAGE CONTRIBUTED SUPERANNUATION ($)	AVERAGE ALLOWANCES ($)	AVERAGE BONUS PAID ($)	AVERAGE TOTAL REMUNERATION ($)
$200,000 and less	3	86,662	10,398	-	5,167	102,227
-	-	-	-	-	-	-
$250,001 to $275,000	3	224,079	36,644	-	10,425	271,148
$275,001 to $300,000	2	241,014	30,703	-	17,715	289,432
$300,001 to $325,000	1	254,061	40,483	-	16,860	311,404
$325,001 to $350,000	2	277,960	42,449	-	17,873	338,281
-	-	-	-	-	-	-
$375,001 to $400,000	1	350,931	20,049	-	25,050	396,029
$400,001 to $425,000	2	337,867	50,500	-	23,396	411,763
$425,001 to $450,000	1	400,107	20,049	-	17,745	437,901
-	-	-	-	-	-	-
$475,001 to $500,000	1	387,605	68,277	-	25,410	481,291
-	-	-	-	-	-	-
$650,001 to $675,000	1	535,077	94,254	-	25,050	654,382
-	-	-	-	-	-	-
$850,001 to $875,000	1	664,916	20,049	-	173,312	858,277
Total number of executives	**18**					

TABLE 4.2: AVERAGE ANNUAL REPORTABLE REMUNERATION PAID TO SUBSTANTIVE STAFF EARNING ABOVE $200,001 IN 2017–18

TOTAL REMUNERATION	STAFF (NO)	AVERAGE REPORT-ABLE SALARY ($)	AVERAGE CONTRIBUTED SUPER-ANNUATION ($)	AVERAGE ALLOWANCES ($)	AVERAGE BONUS PAID ($)	AVERAGE TOTAL REMUNER-ATION ($)
$200,001 to $225,000	101	178,447	29,880	-	2,662	210,989
$225,001 to $250,000	59	197,661	31,387	-	6,809	235,857
$250,001 to $275,000	29	214,651	35,056	-	11,491	261,198
$275,001 to $300,000	5	234,186	36,047	-	14,925	285,158
$300,001 to $325,000	7	264,161	37,193	-	8,845	310,199
$325,001 to $350,000	5	281,540	4,4018	-	14,302	339,859
$350,001 to $375,000	4	282,419	44,575	-	33,735	360,729
Total number of substantive staff	**210**					

Disclosure of interests and related entity transactions

Board members and the Chief Executive declare material interests in accordance with the SIR Act and PGPA Act. The Board Governance document contains 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 2017–18, the Board considered the following transactions where a Board member was also a director on the entity involved in the transaction:

- Board 203 Item 5.2, Strategic Alliance with Australian Meat Processors Co (AMPC) – Dr Michele Allan did not receive a copy of the paper and was absent from the Board discussion due to her conflict of duty as Chair of the MLA and the AMPC receiving funding from MLA.

There have been 213 transactions involving entities related to CSIRO above $10,000 which came to a total combined value of $21.34 million.

Risk management

CSIRO is committed to effectively identifying and managing risk as a vital part of successfully capturing the opportunities created through scientific research and delivering on our purpose under the SIR Act. CSIRO undertakes research activities that involve challenging and highly technical science. This inherently carries a significant level of risk. As such, we actively identify, monitor and manage strategic and operational risks that may impact the health, safety and security of our people, the environments in which we operate, the integrity and excellence of our science, the long-term financial sustainability of our organisation and our ability to attract and retain the people that undertake and support our science.

CSIRO manages risk at all levels of the organisation and the management of those risks is the responsibility of all our people. Risk represents one of five organisational policy statements and is supported by our Risk Framework, methodology and approach, which is grounded in and compliant with both the international standard AS/NZS ISO 31000 Risk Management Principles and Guidelines and aligned to the Commonwealth Risk Management Policy.

Our Risk Framework is applied to capture and report risks at the Enterprise, Business Unit/Functional and activity levels within CSIRO. In 2017, CSIRO recognised that while this framework has supported the organisation well, we must continually evolve and improve our approach to strengthen the development of a strong risk culture that supports taking risks mindfully to deliver innovation for Australia. We have therefore undertaken a program of improvement to increase our risk maturity through strengthening the integration of risk into our most critical business processes and enhancing risk capability across the organisation, particularly within our Business Units and in the execution of projects.

CSIRO's Organisational Risk Profile is updated annually to reflect our main strategic and operational risks in alignment with our strategy. It articulates how we manage our key risks at an enterprise level. The Profile is developed in a consultative and considered manner involving extensive engagement with organisational leaders across the Executive and all Business Units and Functions as well as conducting an internal and external environmental scan that considers external, strategic and internally generated risks with the potential to impact the achievement of CSIRO's objectives. Consistent with our objective to increase risk maturity, in coming years we will continue to deepen the level of engagement and analysis that supports the development of the Profile.

In 2017, the Organisational Risk Profile was endorsed at the November Board Audit and Risk Committee meeting and was formally approved by the Board in November 2017. From 2018 this will become a bi-annual process. Updates to the profile are reported through to the ET and Board on a monthly basis. Key risk activities are regularly reported through to the Board Audit and Risk Committee. An Issues Management Team, comprised of business unit and functional leaders, convenes each week to identify, assess and manage issues that have organisational importance. CSIRO's Situation Management Framework supports the management of issues.

General insurance, including General Liability and Professional Indemnity Insurance, is provided through Comcover. CSIRO's worker's compensation liability is covered through a Comcare premium.

Advisory mechanisms

Our Advisory Committees provide advice on our longer-term strategic directions and research and development priorities and on how we can meet the research, technical and business needs of customers and communities. The committees meet at least twice a year, or more regularly if required. The advice provided by these committees relates to the effectiveness of our businesses to achieve their goals. The committees comprise representatives from industry, government, non-government organisations and other stakeholders.

Policies, principles and procedures

The CSIRO Policy Framework comprises policies, principles and procedures. The policies, approved by our Board, reflect CSIRO's commitment in relation to:

- People
- Science and Delivery
- Governance
- Risk
- Health, Safety and Environmental Sustainability
- Freedom to Conduct CSIRO Research and Technology Transfer
- Child Safety
- Finance.

The current CSIRO Policy Reform Project supports the continual streamlining of policies, principles and procedures in CSIRO, and is intended to lead to improved transparency, accountability, efficiency and effectiveness in the daily work of all staff.

Ethics and the Code of Conduct

The CSIRO Code of Conduct sets out the standard of behaviour expected of CSIRO staff and others working in the organisation. All staff members and CSIRO affiliates are required to undertake training on the Code on commencement and every two years.

Ethical conduct is a priority for CSIRO and we have procedures for Ethical Conduct in Human Research, and Animal Welfare regarding the care and use of animals in scientific research. Our practices comply with national codes and relevant state and national legislative requirements. CSIRO operates two human research ethics committees to cover its social and interdisciplinary science, and health and medical-related research. These committees review about 230 new projects each year and provide ongoing monitoring and support for over 400 active projects at any given time. The committees provide independent, expert advice regarding appropriate engagement of people and communities in research and the use of human data. They ensure the effective management of issues such as privacy, informed consent and managing risks and benefits flowing from research.

CSIRO operates five Animal Ethics Committees (AECs) that review CSIRO 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. Approximately 116 new projects are reviewed each year. AECs also play an active role in monitoring the care and wellbeing of animals during any research and ensure CSIRO's compliance with all regulatory requirements. Ongoing support and monitoring is provided for over 220 projects at any given time.

We provide targeted training programs on human and animal research ethics to staff and ethics committee members each year to ensure capability levels for responsible research practice are supported and maintained. We also provide online resources to support best practice. In 2017–18, we began a review of CSIRO's Animal Welfare and Ethical Conduct of Human Research procedures.

Internal controls

CSIRO complies with section 10 of the *Public Governance, Performance and Accountability Rule 2014* (PGPA Rule), which requires CSIRO to establish and maintain an effective fraud control framework. CSIRO's Fraud and Corruption Control Plan comprises strategies to prevent, detect, respond and report to fraud and corruption affecting CSIRO, and is complemented by CSIRO policy and procedures, system and internal controls, financial management, assurance and accountability activities, and an Enterprise Risk framework. CSIRO adheres to the Commonwealth Fraud Control Framework 2017's Fraud Rule, and in line with fraud control best practice, endeavours to apply the Fraud Policy and Fraud Guidance. CSIRO is committed to nurturing an anti-fraud culture, which is predicated on predicting, pre-empting and preventing fraud and misconduct affecting our organisation.

CSIRO adopts elements of both the Protective Security Policy Framework (PSPF) and Information Security Manual (ISM) to inform the organisation's Security Frameworks, comprising both Protective and ICT security elements. CSIRO Security has reviewed the organisation's Risk Appetite Statements and Tolerance Levels, guided by the Enterprise Risk Framework, from which CSIRO will proceed to implement agreed management actions through an endorsed Enterprise Security Program.

We continue to embed Cyber and ICT Security within CSIRO to support our strategy to demonstrate to our customers that we are a trusted advisor.

Reviews by outside bodies

External audit is provided by the Australian National Audit Office (ANAO). In 2017, ANAO conducted a review of CSIRO's corporate plan to assess our progress in implementing the corporate planning requirements under the PGPA Act. The ANAO made three specific recommendations relating to CSIRO. CSIRO accepted the recommendations and committed to implementation starting with the development of the 2018–19 CSIRO Corporate Plan.

The Senate Standing Committees on Economics examines the operations of CSIRO following the Federal Budget, the tabling of the CSIRO Annual Report and the introduction to Parliament of the additional Appropriation Bills. This year, CSIRO senior executives appeared before the Committee on three occasions and responded to all questions on notice.

Judicial decisions

During 2017–18, there were no judicial decisions or decisions of administrative tribunals that have had, or may have, a significant effect on the operations of CSIRO.

Enterprise agreements

Enterprise agreements set the terms and conditions of employment for CSIRO staff. Two enterprise agreements are in operation: the *CSIRO Enterprise Agreement 2017–2020* and the *CDSCC Enterprise Agreement 2014–2017*.

The *CSIRO Enterprise Agreement 2017–2020* came in to operation on 14 August 2017. It reaches its nominal expiry date on 14 November 2020.

The CDSCC Enterprise Agreement reached its nominal expiry date on 18 June 2017. Following a period of negotiations and subsequent staff ballot, the proposed new agreement was not successful. Negotiations will resume.

Service charter

CSIRO's 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 the highest standards.

Our full service charter is available at www.csiro.au/Service-Charter.

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
t 1300 363 400
e csiroenquiries@csiro.au

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 2018, CSIRO received 67 requests for or consultations on documents under the FOI Act.

General information about CSIRO FOI procedures, including how to make an FOI request is available at

www.csiro.au/en/About/Access-to-information/Freedom-of-Information.

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 2017–2018, CSIRO received no requests for amendments of personal information under the FOI Act.

Information Publication Scheme

CSIRO is required to publish information to the public as part of the Information Publication Scheme. This requirement is in Part II of the FOI Act and has replaced 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 accordance with the Information Publication Scheme requirements.

Members of the public may obtain access to scientific and technical publications from CSIRO Publishing (www.publish.csiro.au) and the ePublish Repository (publications.csiro.au). Research data used by CSIRO is routinely published on the CSIRO Data Access Portal (data.csiro.au/dap/browse).

Archives, privacy and administrative decisions

CSIRO maintains an archives collection that includes material from the Council for Science and Industrial Research, the predecessor of CSIRO, dating from 1926. Certain CSIRO records are held by the National Archives of Australia. Disposal arrangements for CSIRO records are made in accordance with the *Archives Act 1983*. Access to records over 20 years old is provided in accordance with that Act.

CSIRO is bound by the Australian Privacy Principles under the *Privacy Act 1988*. CSIRO has various measures in place to manage compliance with the Privacy Act, including the mandatory data breach requirements that came into effect in February 2018. During 2017–18, CSIRO notified the Office of the Australian Information Commissioner (OAIC) of one data breach incident, in respect of which no further action was taken by OAIC. During 2017–18, OAIC undertook no investigations under section 36 of the *Privacy Act 1988* in relation to CSIRO.

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 2017–18, CSIRO 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 and Privacy Officer, CSIRO
GPO Box 1700
Canberra ACT 2601
t 02 6276 6431
e FOI@csiro.au

Public Interest Disclosure

The *Public Interest Disclosure Act 2013* (PID Act) came into effect on 15 January 2014. Internal procedures have been implemented to meet compliance through a Public Interest Disclosure (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 takes appropriate action. CSIRO has contributed to the Commonwealth Ombudsman's annual report on the PID, as required in section 76(3) of the Act. In 2017–18, CSIRO assessed three matters as public interest disclosures under s26 of the PID Act. Two matters proceeded to investigation under s47 of the Act.

Consultancy services

CSIRO engages consultants where it lacks 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, CSIRO considers 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 is made in accordance with the Commonwealth Procurement Rules (CPRs), CSIRO's procurement policy and other relevant internal policies.

CSIRO's 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 4.3, 4.4 and 4.5 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 4.3: ANNUAL SPEND ON CONSULTANCIES

YEAR	SPENT ($)	LET ($) (ESTIMATED WHOLE OF LIFE)
2012–13	1,104,000	1,417,754
2013–14	5,294,552	5,796,633
2014–15	630,870	737,617
2015–16	373,751	853,957
2016–17	1,642,455	1,440,220
2017–18	1,561,210	1,247,100
TOTAL	**10,606,838**	**11,493,281**

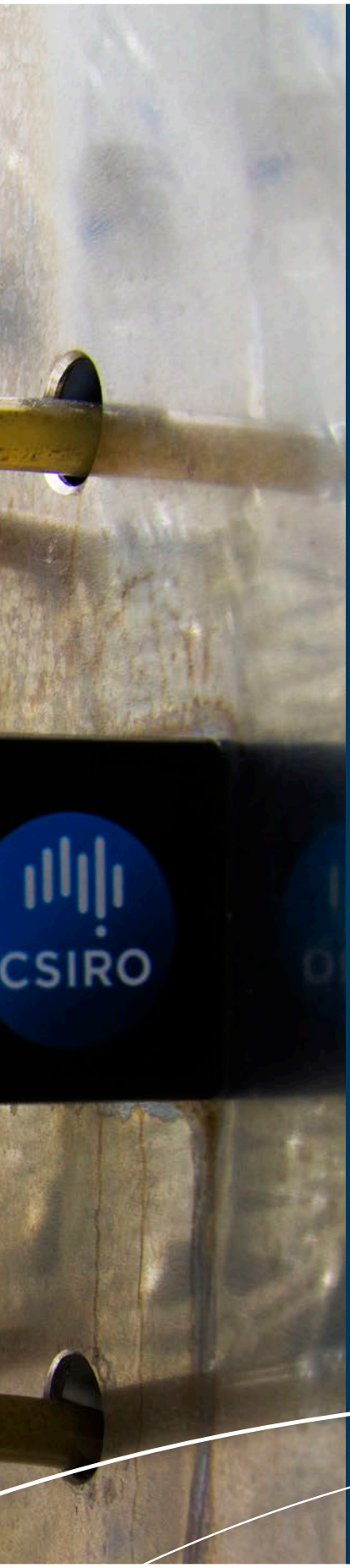
TABLE 4.4: SUMMARY BY REASON CODE

CATEGORY CODE	REASON FOR CONSULTANCY	NUMBER OF CONSULTANCIES	VALUE ($)
IS	Need for independent study/evaluation	19	1,181,890
PA	Need for professional assistance to manage and facilitate change and its consequence	0	0
SS	Specialist skills were not otherwise available	2	65,210
TOTAL		**21**	**1,247,100**

TABLE 4.5: SUMMARY BY PROCUREMENT METHOD CODE

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	0
PM	An existing panel member – this category includes standing offers, common use arrangements and approved supplier panels.	17	1,130,190
ST	Tenders being sought from suppliers who have pre-qualified through some form of previous competitive process.	0	0
RQ	Purchasing was undertaken in accordance with Division 1 of the CPRs and procurement did not require application of Division 2 of the CPRs.	4	116,910
EX	Exemption applied that saw CSIRO undertake the procurement as a Limited Tender as defined in Division 2 of the CPRs.	0	0
TOTAL		**21**	**1,247,100**

Individual digestion chambers measure the rate of biodegradation in new, sprayable, biodegradable polymers. The polymer membranes can help farmers produce more during harvest with less water, nutrients and agrochemicals.



Part 5
Financial statements

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 2018:

(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 2018 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 statements as at 30 June 2018 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 comprising a summary of significant accounting policies and other explanatory information.

The consolidated entity comprises the Commonwealth Scientific and Industrial Research Organisation and its subsidiaries.

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 Commonwealth Scientific and Industrial Research Organisation 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* (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* for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the rules made under that Act. The Board is also responsible for such internal control as the Board determines is necessary to enable the preparation and fair presentation 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 Commonwealth Scientific and Industrial Research Organisation and the consolidated entity's ability 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

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going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

Auditor's Responsibilities for the Audit of the Financial Statements

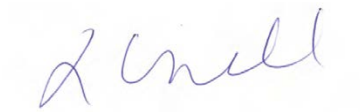
My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that 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 Commonwealth Scientific and Industrial Research Organisation 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 Commonwealth Scientific and Industrial Research Organisation 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 Commonwealth Scientific and Industrial Research Organisation 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 statements. 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 those charged with governance 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



Lesa Craswell
Executive Director

Delegate of the Auditor-General

Canberra
31 August 2018

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION
Financial Statements

for the period ended 30 June 2018

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 year ended 30 June 2018 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 2018

Larry Marshall
Chief Executive and Board Member
31 August 2018

Tom Munyard
Chief Finance Officer
31 August 2018

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF COMPREHENSIVE INCOME
For the period ended 30 June 2018

		Consolidated		CSIRO	
		2018	2017	**2018**	2017
	Notes	**$'000**	$'000	**$'000**	$'000
NET COST OF SERVICES					
Expenses					
Employee benefits	1.1A	**699,295**	693,211	**697,888**	689,208
Suppliers	1.1B	**443,153**	429,404	**447,790**	422,272
Depreciation and amortisation	2.2A	**181,609**	172,166	**181,455**	172,027
Finance leases		**1,562**	2,332	**1,547**	2,321
Write-down and impairment of assets	1.1C	**7,003**	1,890	**6,594**	1,795
Foreign exchange losses - non-speculative		**828**	1,578	**746**	1,519
Loss on revaluation of investment properties		**1,413**	-	**1,413**	-
Losses from asset sales		**15,087**	2,929	**15,087**	2,929
Total expenses		**1,349,950**	1,303,510	**1,352,520**	1,292,071
Own-Source Income					
Own-source revenue					
Sale of goods and rendering of services	1.2	**384,554**	367,532	**405,190**	379,045
Interest - bank and term deposits	1.2	**10,572**	8,752	**7,944**	6,264
Rental income	1.2	**11,001**	12,207	**11,001**	12,207
Royalties and licence fees	1.2	**43,175**	51,107	**43,175**	51,107
Other revenues	1.2	**35,864**	61,911	**31,832**	32,731
Sale of equity investments and intellectual property	1.2	**1,943**	8,258	**-**	1,750
Total own-source revenue		**487,109**	509,767	**499,142**	483,104
Gains					
Gain on recognition of assets		**66**	-	**66**	-
Gain on revaluation of investment properties	1.2	**-**	888	**-**	888
Total gains		**66**	888	**66**	888
Total own-source income		**487,175**	510,655	**499,208**	483,992
Net cost of services		**(862,775)**	(792,855)	**(853,312)**	(808,079)
Revenue from Government	1.2	**793,549**	787,267	**793,549**	787,267
Surplus/(Deficit)		**(69,226)**	(5,588)	**(59,763)**	(20,812)
OTHER COMPREHENSIVE INCOME					
Items not subject to subsequent reclassification to net cost of services					
Increase/(decrease) in asset revaluation reserves	1.3A	**110,554**	-	**110,554**	-
Items subject to subsequent reclassification to net cost of services					
Increase/(decrease) in other reserves	1.3B	**9,853**	7,080	**5,617**	2,048
Total other comprehensive income		**120,407**	7,080	**116,171**	2,048
Total comprehensive income/(loss)		**51,181**	1,492	**56,408**	(18,764)

The above Statement should be read in conjunction with the accompanying notes.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF FINANCIAL POSITION
as at 30 June 2018

		Consolidated		CSIRO	
		2018	2017	**2018**	2017
	Notes	**$'000**	$'000	**$'000**	$'000
ASSETS					
Financial Assets					
Cash and cash equivalents		**321,647**	299,867	**183,974**	151,071
Trade and other receivables	2.1A	**84,165**	82,947	**80,801**	76,613
Other investments	2.1B	**77,516**	36,212	**98,714**	69,821
Total financial assets		**483,328**	419,026	**363,489**	297,505
Non-Financial Assets					
Land and buildings	2.2A	**1,625,607**	1,575,886	**1,625,607**	1,575,886
Plant and equipment	2.2A	**548,632**	572,400	**548,296**	572,015
Heritage and cultural	2.2A	**4,463**	4,206	**4,463**	4,206
Intangibles	2.2A	**16,573**	19,780	**16,573**	19,780
Investment properties	2.2B	**49,697**	51,110	**49,697**	51,110
Inventories		**1,440**	1,474	**1,440**	1,474
Other non-financial assets	2.2C	**44,295**	41,337	**44,271**	41,399
Total non-financial assets		**2,290,707**	2,266,193	**2,290,347**	2,265,870
Properties held for sale		**5,200**	5,200	**5,200**	5,200
Total assets		**2,779,235**	2,690,419	**2,659,036**	2,568,575
LIABILITIES					
Payables					
Suppliers	2.3A	**83,844**	73,590	**82,112**	70,661
Other payables	2.3B	**142,332**	129,243	**136,361**	124,809
Total payables		**226,176**	202,833	**218,473**	195,470
Interest Bearing Liabilities					
Finance Leases	2.4A	**31,968**	37,755	**31,968**	37,755
Deposits	2.4B	**12,315**	5,178	**12,336**	8,345
Total Interest bearing liabilities		**44,283**	42,933	**44,304**	46,100
Provisions					
Employee provisions	3.1A	**218,956**	217,164	**218,774**	217,078
Provision for remediation		**29,815**	28,665	**29,815**	28,665
Total provisions		**248,771**	245,829	**248,589**	245,743
Total liabilities		**519,230**	491,595	**511,366**	487,313
Net assets		**2,260,005**	2,198,824	**2,147,670**	2,081,262
EQUITY					
Contributed equity		**290,954**	280,954	**290,646**	280,646
Asset revaluation reserves		**1,492,286**	1,381,732	**1,492,286**	1,381,732
Other reserves		**15,229**	5,376	**5,982**	365
Retained surplus		**461,536**	530,762	**358,756**	418,519
Total equity		**2,260,005**	2,198,824	**2,147,670**	2,081,262

The above Statement should be read in conjunction with the accompanying notes.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF CHANGES IN EQUITY – CONSOLIDATED
For the period ended 30 June 2018

	Retained earnings		Asset revaluation reserve		Other reserves		Contributed equity/capital		Total equity	
	2018	2017	**2018**	2017	**2018**	2017	**2018**	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000
Opening balance	**530,762**	532,021	**1,381,732**	1,387,548	**5,376**	(1,704)	**280,954**	270,954	**2,198,824**	2,188,819
Comprehensive income										
Other comprehensive income[1]	**-**	-	**110,554**	-	**9,853**	7,080	**-**	-	**120,407**	7,080
Surplus/(deficit) for the period	**(69,226)**	(5,588)	**-**	-	**-**	-	**-**	-	**(69,226)**	(5,588)
Total comprehensive income	**(69,226)**	(5,588)	**110,554**	-	**9,853**	7,080	**-**	-	**51,181**	1,492
Other movements[2]	**-**	4,329	**-**	(5,816)	**-**	-	**-**	-	**-**	(1,487)
Contributions by owners										
Equity injection	**-**	-	**-**	-	**-**	-	**10,000**	10,000	**10,000**	10,000
Contributions by owners – other	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Closing balance	**461,536**	530,762	**1,492,286**	1,381,732	**15,229**	5,376	**290,954**	280,954	**2,260,005**	2,198,824

The above Statement should be read in conjunction with the accompanying notes.

1. Refer to Note 1.3.
2. Other movements relates to the NICTA asset revaluation reserves being written back to retained earnings following disposal of their assets (which were transferred to CSIRO).

Accounting Policy

Equity Injections

Amounts that are designated as equity injections for a year are recognised directly in contributed equity in that year.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF CHANGES IN EQUITY – CSIRO
For the period ended 30 June 2018

	Retained earnings		Asset revaluation reserve		Other reserves		Contributed equity/capital		Total equity	
	2018	2017	**2018**	2017	**2018**	2017	**2018**	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000
Opening balance	**418,519**	439,331	**1,381,732**	1,381,732	**365**	(1,683)	**280,646**	270,646	**2,081,262**	2,090,026
Comprehensive income										
Other comprehensive income[1]	**-**	-	**110,554**	-	**5,617**	2,048	**-**	-	**116,171**	2,048
Surplus/(deficit) for the period	**(59,763)**	(20,812)	**-**	-	**-**	-	**-**	-	**(59,763)**	(20,812)
Total comprehensive income	**(59,763)**	(20,812)	**110,554**	-	**5,617**	2,048	**-**	-	**56,408**	(18,764)
Contributions by owners										
Equity injection	**-**	-	**-**	-	**-**	-	**10,000**	10,000	**10,000**	10,000
Contributions by owners – other	**-**	-	**-**	-		-	**-**	-	**-**	-
Closing balance	**358,756**	418,519	**1,492,286**	1,381,732	**5,982**	365	**290,646**	280,646	**2,147,670**	2,081,262

The above Statement should be read in conjunction with the accompanying notes.

1. Refer to Note 1.3.

CONSOLIDATED FINANCIAL STATEMENTS
CASH FLOW STATEMENT
For the period ended 30 June 2018

		Consolidated		CSIRO	
		2018	2017	**2018**	2017
	Notes	**$'000**	$'000	**$'000**	$'000
OPERATING ACTIVITIES					
Cash received					
Receipts from Government		**793,549**	787,267	**793,549**	787,267
Sale of goods and rendering of services		**502,153**	505,742	**524,053**	488,180
Interest		**9,833**	8,952	**7,468**	6,453
Net GST received		**14,947**	19,728	**17,073**	17,523
Deposits		**7,138**	-	**3,992**	1,530
Total cash received		**1,327,620**	1,321,689	**1,346,135**	1,300,953
Cash used					
Employees		**697,537**	712,103	**696,223**	701,014
Suppliers		**486,039**	481,396	**497,370**	479,965
Finance costs		**1,562**	2,332	**1,547**	2,321
Deposits		**-**	587	**-**	-
Total cash used		**1,185,138**	1,196,418	**1,195,140**	1,183,300
Net cash from operating activities		**142,482**	125,271	**150,995**	117,653
INVESTING ACTIVITIES					
Cash received					
Proceeds from sales of property, plant and equipment		**5,090**	3,298	**5,074**	3,178
Proceeds from sales of equity investments and intellectual property		**5,391**	6,508	**-**	-
Total cash received		**10,481**	9,806	**5,074**	3,178
Cash used					
Purchase of property, plant and equipment		**116,631**	139,692	**116,510**	138,973
Equity investments		**18,696**	3,288	**10,800**	13,288
Other selling costs		**69**	59	**69**	59
Total cash used		**135,396**	143,039	**127,379**	152,320
Net cash used in investing activities		**(124,915)**	(133,233)	**(122,305)**	(149,142)
FINANCING ACTIVITIES					
Cash received					
Contributed equity		**10,000**	10,000	**10,000**	10,000
Total cash received		**10,000**	10,000	**10,000**	10,000
Cash used					
Finance leases		**5,787**	4,267	**5,787**	4,267
Total cash used		**5,787**	4,267	**5,787**	4,267
Net cash from financing activities		**4,213**	5,733	**4,213**	5,733
Net increase (decrease) in cash held		**21,780**	(2,229)	**32,903**	(25,756)
Cash and cash equivalents at the beginning of the reporting period		**299,867**	302,096	**151,071**	176,827
Cash and cash equivalents at the end of the reporting period		**321,647**	299,867	**183,974**	151,071

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 the 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.

CSIRO is structured to meet the following outcome:

> 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.

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) for reporting periods ending on or after 1 July 2015; 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 3.1 Employee Provisions
- Note 4.3 Fair Value Measurements

CSIRO has a provision (raised under other provisions) for remediation costs required at a remote CSIRO location, based on estimates provided by internal and external qualified experts. The provision is predominantly 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 2018. As the remediation process progresses, the scope and costs may be subject to change. The work is expected to take several years to reach completion.

Consolidation

The consolidated financial statements comprise the financial statements of the CSIRO and its subsidiaries (referred to as 'the Group'). The subsidiaries of CSIRO are WLAN Services Pty Ltd (WLAN), the Science and Industry Endowment Fund (SIEF), the CSIRO Chile Research Fundación (Fundación), National ICT Australia (NICTA), the Innovation Fund (eight entities) and the US Office (2 entities). Refer to Note 3.6 for further information.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

The consolidated financial statements incorporate the assets and liabilities of all entities controlled by CSIRO as at 30 June 2018 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.

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. 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

Adoption of new Australian Accounting Standard requirements

No Accounting Standard has been adopted earlier than the application date as stated in the standard. CSIRO has reviewed new standards, revised standards and interpretations/amending standards issued prior to the signing of the financial statements and considers that none of these have had a material financial impact.

Future Australian Accounting Standard requirements

No new or revised pronouncements that were issued by the Australian Accounting Standards Board prior to the finalisation of the financial statements are expected to have a material financial impact on the entity in future reporting periods. The following new or revised standards will be adopted and their implementation will require enhanced disclosure in future reporting periods:

Standard	Effective for reporting periods beginning on or after:	Nature of impending changes and likely impact on application
AASB 9 *Financial Instruments*	1 January 2018	Change to requirements for classifying and measuring financial assets and liabilities. Assessed as a moderate impact on the recognition and measurement of financial instruments.
AASB 15 *Revenue from Contracts with Customers*	1 January 2019	Specifies the accounting treatment of revenue arising from contracts with customers. CSIRO considers this will have minimal impact.
AASB 16 *Leases*	1 January 2019	Moderate impact as a new accounting standard which requires assessment of all operating and finance leases.

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. WLAN and 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.

Events after the Reporting Period

At the time of completion of these 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 requires relocation 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 become effective in November 2016.

This initial step in rezoning the land has allowed CSIRO to commence a process to identify a suitable development partner to progress with the next steps in the planning for the future of the site which will involve ongoing significant community and stakeholder consultation. The process of selecting a development partner is anticipated to be finalised in 2018-2019. As the development of the site 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 2018.

1.1. Expenses

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 1.1A: Employee Benefits				
Wages and salaries	**528,356**	522,115	**527,117**	518,203
Superannuation	**92,215**	89,374	**92,140**	89,315
Leave and other entitlements	**88,263**	67,945	**88,170**	67,898
Separation and redundancies	**(2,135)**	20,826	**(2,135)**	20,826
Gross employee benefits	**706,699**	700,260	**705,292**	696,242
Less				
Capitalised labour	**(7,014)**	(6,623)	**(7,014)**	(6,623)
Employee cost recovery from subsidiary companies	**(390)**	(426)	**(390)**	(411)
Total employee benefits	**699,295**	693,211	**697,888**	689,208

Accounting Policy

Accounting policy for employee related expenses is contained in the People and Relationships section.

Note 1.1B: Suppliers				
Goods supplied	**103,154**	91,941	**102,709**	91,975
Services rendered	**328,563**	323,663	**333,692**	316,558
Total goods and services supplied or rendered	**431,717**	415,604	**436,401**	408,533
Other suppliers				
Operating lease rentals - minimum lease payments	**5,416**	6,333	**5,416**	6,333
Workers compensation expenses	**6,020**	7,467	**5,973**	7,406
Total other suppliers	**11,436**	13,800	**11,389**	13,739
Total Suppliers	**443,153**	429,404	**447,790**	422,272

Leasing commitments

The CSIRO in its capacity as lessee has the following commitments that arise from effectively non-cancellable operating leases:

1. Office and Scientific Research Accommodation - Lease payments are subject to annual increases in accordance with the terms of the agreement (such as CPI increases). The accommodation leases are current and each may be renewed at the Group's option.
2. Motor Vehicles - No contingent rentals exist and there are no purchases options for vehicle leases.
3. Computer Equipment - Provision of computer equipment as designated necessary in the supply contract for a general period of 2-3 years.

Commitments below are stated inclusive of GST.

Commitments for minimum lease payments in relation to non-cancellable operating leases are payable as follows:

Within 1 year	**38,614**	36,152	**38,029**	35,622
Between 1 to 5 years	**100,152**	127,704	**99,300**	126,978
More than 5 years	**18,060**	21,106	**18,060**	21,106
Total operating lease commitments	**156,826**	184,962	**155,389**	183,706

Accounting Policy

Research and Development Expenditure and Intellectual Property

All research and development costs, including costs associated with protecting intellectual property (e.g. patents and trademarks), are expensed as incurred.

Leases

A distinction is made between finance leases and operating leases. Finance leases effectively transfer from the lessor to the lessee substantially all the risks and rewards incidental to ownership of leased assets. An operating lease is a lease that is not a finance lease. In operating leases, the lessor effectively retains all such risks and benefits.

Where an asset is acquired by means of a finance lease, the asset is capitalised at either the fair value of the lease or, if lower, the present value of minimum lease payments at the inception of the contract and a liability recognised at the same time and for the same amount.

The discount rate used is the interest rate implicit in the lease. Leased assets are amortised over the period of the lease. Lease payments are allocated between the principal component and the interest expense.

Operating lease payments are expensed on a straight-line basis which is representative of the pattern of benefits derived from the leased assets.

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 1.1C: Write-down and impairment of assets				
Asset write-downs and impairments from:				
Bad debts	**52**	263	**52**	263
Increase/(decrease) in allowance for impairment of receivable	**632**	(1)	**632**	(1)
Impairment of available for sale investments	**409**	520	**-**	425
Write down and impairment of assets	**5,910**	1,108	**5,910**	1,108
Total write-down and impairment of assets	**7,003**	1,890	**6,594**	1,795

CONSOLIDATED FINANCIAL STATEMENTS
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1.2. Revenue and Gains

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Revenues from Government	**793,549**	787,267	**793,549**	787,267
Sale of goods	**10,593**	9,950	**10,593**	9,950
Rendering of services	**373,961**	357,582	**394,597**	369,095
Total sale of goods and rendering of services	**384,554**	367,532	**405,190**	379,045
Bank and term deposits interest	**10,572**	8,752	**7,944**	6,264
Rental Income	**11,001**	12,207	**11,001**	12,207
Royalties and licence fees	**43,175**	51,107	**43,175**	51,107
Gain on sale of investments or intellectual property	**1,943**	8,258	**-**	1,750
Total interest, rental, royalties and licence income	**66,691**	80,324	**62,120**	71,328
Other revenues				
Sale of primary produce	**1,916**	1,035	**1,916**	1,035
Donation	**22**	25,010	**22**	10
Capital contributions	**17,263**	16,822	**17,263**	16,822
Education programs and subscriptions	**513**	199	**513**	199
Other	**16,150**	18,845	**12,118**	14,665
Total other revenues	**35,864**	61,911	**31,832**	32,731
Total own-source revenue	**487,109**	509,767	**499,142**	483,104
Gain on recognition of assets	**66**	-	**66**	-
Gain on revaluation of investment properties	**-**	888	**-**	888
Total own-source revenue including gains	**487,175**	510,655	**499,208**	483,992

Leasing - Rental Income Commitments

CSIRO has commitments receivable for the sub leasing areas of office and scientific research accommodation to external parties. The commitments below are shown at their GST inclusive amounts:

Within 1 year	**3,549**	4,012	**3,549**	4,012
Between 1 to 5 years	**5,401**	6,211	**5,401**	6,211
More than 5 years	**3,846**	4,100	**3,846**	4,100
Total lease commitments receivable	**12,796**	14,323	**12,796**	14,323

Accounting Policy

Sale of Goods and Services Revenue

Revenue from sale of goods is recognised when:

- The risks and rewards of ownership have been transferred to the buyer;
- The entity retains no managerial involvement or effective control over the goods;
- The revenue and transaction costs incurred can be reliably measured; and
- It is probable that the economic benefits associated with the transaction will flow to CSIRO.

Revenue from rendering of services is recognised by reference to the stage of completion of contracts at the reporting date. The revenue is recognised when:

- The amount of revenue, stage of completion and transaction costs incurred can be reliably measured; and
- It is probable that the economic benefits associated with the transaction will flow to CSIRO.

The stage of completion of contracts at the reporting date is determined by reference to the estimated progress of the contracted deliverables to date. The balances of contract research and development activities in progress are accounted as either contract research work in progress (Note 2.2C), being the gross unbilled amount expected to be collected from clients for contract research and services performed as at 30 June 2018, or contract research revenue received in advance (Note 2.3B), where revenue for contract research and services received and/or billed exceeded revenue earned.

Interest Revenue

Interest revenue is recognised using the effective interest method as set out in AASB 139 *Financial Instruments: Recognition and Measurement*.

Royalties and License Fees

Royalties and licence revenue are recognised on an accrual basis in accordance with the substance of the relevant royalty agreements. Revenue from legal settlements related to intellectual property is recognised on an accrual basis in accordance with the substance of the relevant licensing agreements.

Revenues from Government

Funding received from the Australian Government Department of Industry and Science (appropriated to CSIRO as a corporate Commonwealth entity payment item) is recognised as Revenue from Government unless it is in the nature of an equity injection or a loan.

Other Revenue

Other revenues includes sale of CSIRO publications and products, conferences and 'pass through' funding for costs of suppliers and external service providers.

Resources Received Free of Charge

Resources received free of charge are recognised as either revenue or gains depending on their nature. They are recorded as revenue when, and only when, the fair value can be reliably determined and the services would have been purchased if they had not been donated. Use of those resources is recognised as an expense.

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 agency or authority as a consequence of a restructuring of administrative arrangements.

Sale of Assets

Gains from disposal of non-current assets are recognised when control of the asset has passed to the buyer.

1.3. Other Comprehensive Income

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Items that will not be classified to income or loss				
Note 1.3A: Changes in asset revaluation reserves				
Revaluation of land and buildings	**110,297**	-	**110,297**	-
Revaluation of plant and equipment	**-**	-	**-**	-
Revaluation of heritage and cultural assets	**257**	-	**257**	-
Net increase/(decrease) in asset revaluation reserves	**110,554**	-	**110,554**	-
Items that may be reclassified to income and loss				
Note 1.3B: Change in other reserve				
Net change in fair value gain/(loss) of available for sale assets	**9,861**	7,096	**5,617**	2,048
Net change arising from foreign exchange movements on conversion of subsidiary accounts	**(8)**	(16)	**-**	-
Realisation of fair value loss on sale and impairment of available for sale investment	**-**	-	**-**	-
Net increase/(decrease) in other reserve	**9,853**	7,080	**5,617**	2,048

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	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 2.1A: Trade and other receivables				
Goods and services	**74,406**	76,167	**73,951**	72,495
Statutory receivables	**4,755**	3,761	**4,433**	3,608
Interest	**1,622**	883	**919**	443
Other receivables	**4,216**	2,338	**2,332**	269
Total trade and other receivables (gross)	**84,999**	83,149	**81,635**	76,815
Less: impairment allowance for trade and other receivables	**(834)**	(202)	**(834)**	(202)
Total trade and other receivables (net)	**84,165**	82,947	**80,801**	76,613
Trade and other receivables (gross) aged as follows				
Not overdue	**73,154**	71,492	**73,159**	65,159
Overdue by				
0 to 30 days	**8,628**	7,727	**5,259**	7,727
31 to 60 days	**1,391**	2,129	**1,391**	2,129
61 to 90 days	**500**	232	**500**	231
More than 90 days	**1,326**	1,569	**1,326**	1,569
Total receivables (gross)	**84,999**	83,149	**81,635**	76,815
Reconciliation of impairment allowance				
Opening balance	**202**	354	**202**	354
Increase /(decrease) recognised in net surplus	**632**	(152)	**632**	(152)
Closing balance	**834**	202	**834**	202

Accounting Policy

Loans and Receivables

Receivables for goods and services, which have 30 day terms, are recognised at the nominal amounts due less any impairment allowance. Collectability of debts is reviewed on an ongoing basis and allowances are made when collectability of the debt is no longer probable. All trade and other receivables are expected to be recovered in no more than 12 months.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period. Where there is objective evidence that an impairment loss has been incurred for loans and receivables, the amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows discounted at the asset's original effective interest rate. The carrying amount is reduced by way of an allowance account. The loss is recognised in the Statement of Comprehensive Income.

Note 2.1B: Other Investments				
Listed companies	**5,846**	3,455	**5,846**	3,455
Unlisted companies	**42,258**	22,992	**32,677**	16,601
Innovation Fund	**20,021**	-	**50,800**	40,000
Uniseed Investment	**9,391**	9,765	**9,391**	9,765
Total investments	**77,516**	36,212	**98,714**	69,821

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.

CSIRO's investments in listed and unlisted companies are accounted for in accordance with AASB 139 *Financial Instruments: Recognition and Measurement*, and have been designated as 'available-for-sale' financial assets. See note 4.2 for further information.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

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 2018 - Consolidated

	Land	Buildings	Total land and buildings	Plant and equipment	Heritage and cultural	Intangibles	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
As at 1 July 2017							
Gross book value	384,489	2,738,327	3,122,816	1,152,126	11,947	53,280	4,340,169
Accumulated depreciation and amortisation	-	(1,546,930)	(1,546,930)	(579,726)	(7,741)	(33,500)	(2,167,897)
Net book value as at 1 July 2017	384,489	1,191,397	1,575,886	572,400	4,206	19,780	2,172,272
Additions:							
By purchase	-	36,175	36,175	78,127	-	2,329	116,631
Assets first recognised through a gain in net cost of services	-	-	-	-	-	-	-
Reclassification	(40)	7,113	7,073	(7,073)	-	-	-
Revaluations recognised in other comprehensive income	57,001	53,296	110,297	-	257	-	110,554
Impairments recognised in net cost of services	-	(4,024)	(4,024)	1,559	-	-	(2,465)
Depreciation expense	-	(98,818)	(98,818)	(77,302)	-	(5,489)	(181,609)
Disposals	(850)	(132)	(982)	(19,079)	-	(47)	(20,108)
Other movements	-	-	-	-	-	-	-
Net book value as at 30 June 2018	440,600	1,185,007	1,625,607	548,632	4,463	16,573	2,195,275
Net book value as at 30 June 2018 represented by:							
Gross book value	440,600	2,613,649	3,054,249	1,149,408	13,997	53,585	4,271,239
Accumulated depreciation and amortisation	-	(1,428,642)	(1,428,642)	(600,776)	(9,534)	(37,012)	(2,075,964)
Total as at 30 June 2018	440,600	1,185,007	1,625,607	548,632	4,463	16,573	2,195,275

(b) Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles for 2018 - CSIRO

	Land	Buildings	Total land and buildings	Plant and equipment	Heritage and cultural	Intangibles	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
As at 1 July 2017							
Gross book value	384,489	2,738,327	3,122,816	1,151,430	11,947	53,280	4,339,473
Accumulated depreciation and amortisation	-	(1,546,930)	(1,546,930)	(579,415)	(7,741)	(33,500)	(2,167,586)
Net book value as at 1 July 2017	384,489	1,191,397	1,575,886	572,015	4,206	19,780	2,171,887
Additions:							
By purchase	-	36,175	36,175	78,006	-	2,329	116,510
Assets first recognised through a gain in net cost of services	-	-	-	-	-	-	-
Reclassification	(40)	7,113	7,073	(7,073)	-	-	-
Revaluations recognised in other comprehensive income	57,001	53,296	110,297	-	257	-	110,554
Impairments recognised in net cost of services	-	(4,024)	(4,024)	1,559	-	-	(2,465)
Depreciation expense	-	(98,818)	(98,818)	(77,148)	-	(5,489)	(181,455)
Disposals	(850)	(132)	(982)	(19,063)	-	(47)	(20,092)
Other movements	-	-	-	-	-	-	-
Net book value as at 30 June 2018	440,600	1,185,007	1,625,607	548,296	4,463	16,573	2,194,939
Net book value as at 30 June 2018 represented by:							
Gross book value	440,600	2,613,649	3,054,249	1,148,590	13,997	53,585	4,270,421
Accumulated depreciation and amortisation	-	(1,428,642)	(1,428,642)	(600,294)	(9,534)	(37,012)	(2,075,482)
Total as at 30 June 2018	440,600	1,185,007	1,625,607	548,296	4,463	16,573	2,194,939

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'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	**28,141**	42,020	**28,141**	42,020
Plant and equipment	**8,199**	3,954	**8,199**	3,954
Total commitments payable	**36,340**	45,974	**36,340**	45,974
Within 1 year	**36,166**	45,974	**36,166**	45,974
Between 1 to 5 years	**174**	-	**174**	-
More than 5 years	**-**	-	**-**	-
Total commitments payable	**36,340**	45,974	**36,340**	45,974

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. Financial assets are initially measured at their fair value plus transaction costs where appropriate.

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. Property, plant and equipment which are purchased from contract research funds and where the control and subsequent sale proceeds are refunded to contributors under the terms of the agreements, are expensed during the year of purchase.

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).

Revaluations

Following initial recognition at cost, property, plant and equipment, including assets under finance leases 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. The regularity of valuation depends upon the volatility of movements in the market values for the relevant assets.

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 is determined as follows:

- Land, which will continue to be used 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 2018 by Jones Lang LaSalle (JLL).
- Buildings and leasehold improvements, which will continue to be used for research activities, 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 2018 by JLL.
- Plant and equipment which will continue to be used for research activities are valued by independent valuers at fair value (highest and best use). Plant and equipment assets were revalued as at 30 June 2016 by Australian Valuation Solutions.
- Properties held for sale are valued at fair value annually. The property held for sale is valued at its contracted sale price.
- Heritage and cultural assets are valued by independent valuers at their depreciated replacement cost. Heritage assets underwent a full revaluation as at 30 June 2018 by JLL.

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.

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:

Buildings on freehold land	40 to 80 years
Leasehold improvements	Lease term
Buildings under finance lease	Lease term
Passenger vehicles	7 years
Agricultural and transport equipment	8 to 20 years
Computing equipment	2 to 5 years
Scientific equipment	5 to 20 years
Furniture and office equipment	5 to 15 years
Workshop equipment	20 to 25 years
Research vessel	25 years
Australia telescope	15 to 58 years
Heritage and cultural assets	Indefinite

Impairment

All assets were assessed for impairment as at 30 June 2018. Where indications 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 (2017: 2 to 10 years). All software assets were assessed for indications of impairment as at 30 June 2018.

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	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 2.2B: Investment properties				
Reconciliation of the opening and closing balances of investment properties				
As at 1 July	**51,110**	50,222	**51,110**	50,222
Net gain/(loss) from fair value adjustments	**(1,413)**	888	**(1,413)**	888
Total as at 30 June	**49,697**	51,110	**49,697**	51,110

Commitments from investment properties:

Commitments comprise rental income receivable from CSIRO's investment properties. The commitments below are shown at their GST inclusive amounts:

Within 1 year	**3,701**	3,159	**3,701**	3,159
Between 1 to 5 years	**825**	1,050	**825**	1,050
More than 5 years	**-**	-	**-**	-
Total commitment receivable	**4,526**	4,209	**4,526**	4,209

No indicators of impairment were identified for investment properties.

Accounting Policy

Investment properties are recorded at their fair value, which is assessed annually by independent valuers. Investment properties were valued as at 30 June 2018 by JLL. Revaluation increments are recorded as a gain or loss in the Statements of Comprehensive Income as disclosed in Note 1.2. Rental income from investment properties is included in the rental income disclosed in Note 1.2 and was $3.2m for 2018 (2017:$3.3m). Operating costs that are recoverable amounted to $0.5m (2017: $1.0m)

Note 2.2C: Other non-financial assets				
Contract research work in progress - at cost	**29,253**	28,322	**29,253**	28,322
Other prepayments	**15,042**	13,015	**15,018**	13,077
Total other non-financial assets	**44,295**	41,337	**44,271**	41,399

No indicators of impairment were identified for other non-financial assets.

Accounting Policy

Accounting policy for contract research work in progress is contained in Note 1.2.

2.3. Payables

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 2.3A: Suppliers				
Suppliers payable	**83,844**	73,590	**82,112**	70,661
Total	**83,844**	73,590	**82,112**	70,661

Suppliers payable are expected to be settled within 12 months.
Settlement is usually made within 30 days.

Note 2.3B: Other Payables				
Accrued salaries and wages	**6,380**	6,232	**6,380**	6,229
Contract research revenue received in advance	**118,268**	105,734	**118,268**	105,734
Other revenue received in advance	**8,936**	14,975	**9,616**	10,407
Other creditors and accrued expenses	**8,748**	2,302	**2,097**	2,439
Total other payables	**142,332**	129,243	**136,361**	124,809

Accounting Policy

Accounting policy for contract revenue received in advance is contained in Note 1.2.

2.4. Interest Bearing Liabilities

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 2.4A: Finance Leases				
Lease payments are expected to be settled:				
Within one year				
Minimum lease payments	**5,567**	5,480	**5,567**	5,480
Deduct: future finance charges	**(1,566)**	(1,643)	**(1,566)**	(1,643)
Total payable within one year (current)	**4,001**	3,837	**4,001**	3,837
In one to five years				
Minimum lease payments	**24,680**	23,649	**24,680**	23,649
Deduct: future finance charges	**(3,911)**	(4,245)	**(3,911)**	(4,245)
Total payable within one to five years	**20,769**	19,404	**20,769**	19,404
In more than five years				
Minimum lease payments	**8,177**	15,044	**8,177**	15,044
Deduct: future finance charges	**(979)**	(530)	**(979)**	(530)
Total payable in more than five years	**7,198**	14,514	**7,198**	14,514
Total finance lease liability recognised on the Statement of Financial Position	**31,968**	37,755	**31,968**	37,755

Accounting Policy

Finance leases exist in relation to certain buildings and major equipment assets. The leases are non-cancellable and for fixed terms ranging from 17 to 25 years. CSIRO guarantees the residual values of all assets leased. There are no contingent rentals. The interest rate implicit in the leases averaged 5% per annum (2017: 4% per annum). The lease liabilities are secured by the lease assets. Accounting policies for leases is contained in Note 1.1B.

Note 2.4B: 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.

Total deposits held are:	**12,315**	5,178	**12,336**	8,345

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	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 3.1A: Employee Provisions				
Annual leave	**58,639**	54,405	**58,457**	54,319
Long service leave	**141,990**	133,684	**141,990**	133,684
Severance pay	**6,523**	5,553	**6,523**	5,553
Redundancies	**11,804**	23,522	**11,804**	23,522
Total employee provisions	**218,956**	217,164	**218,774**	217,078

Accounting Policy

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, long service leave and severance payments. 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 2018 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), or the PSS accumulation plan (PSSap). 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 by the Department of Finance as an administered item.

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 2018 represents outstanding contributions for the financial year.

3.2. Key Management Personnel Remuneration

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Short-term employee benefits				
Salary	**5,692**	5,552	**5,407**	5,292
Performance bonuses	**492**	574	**492**	574
Additional allowances	**277**	276	**276**	275
Total short-term employee benefits	**6,461**	6,402	**6,175**	6,141
Post-employment benefits				
Superannuation	**714**	687	**714**	687
Total post-employment benefits	**714**	687	**714**	687
Other long-term employee benefits				
Annual leave accrued	**409**	435	**409**	411
Long-service leave accrued	**286**	194	**286**	194
Total other long-term benefits	**695**	629	**695**	605
Termination benefits				
Termination benefits	**-**	-	**-**	-
Total termination benefits	**-**	-	**-**	-
Total key management personnel remuneration	**7,870**	7,718	**7,584**	7,433

The total number of key management personnel that are included in the above table for CSIRO is 21 (2017: 21) and for the Group is 22 (2017: 22). This note has been prepared on an accrual basis for substantive and long term acting senior management personnel during the period.

3.3. Remuneration of Auditors

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$	$	**$**	$
Amounts received or due and receivable by the Group's auditors for:				
Audit of the financial statements	**331,970**	309,520	**215,000**	198,000
Audit of projects	**9,980**	-	**-**	-
	341,950	309,520	**215,000**	198,000

The Group's auditor (except for the Fundacion) is the Australian National Audit Office (ANAO) who has appointed RSM to assist with the assignment since 2015-16. The Fundacion is audited by Ernst & Young Chile, who conduct both financial statement and project audits for the Fundacion.

3.4. Remuneration of Board Members

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$	$	**$**	$
Remuneration and superannuation benefits received or due and receivable by full-time and part-time Board Members, excluding the Chief Executive Officer were:				
Board Members' remuneration	**772,171**	720,890	**710,075**	671,477
Payments to superannuation funds for Board Members	**60,452**	57,483	**60,452**	57,483
Total remuneration	**832,623**	778,373	**770,527**	728,960

The remuneration of the Chief Executive Officer, who is also a Board Member of the Group is reported under Note 3.2 Key Management Personnel Remuneration. The total headcount of Board members that are included in the above table for CSIRO is 9 (2017: 9).

For the Group the total head count of Board members was 11 (2017: 11). The NICTA Board has 3 members, all of whom are CSIRO staff who do not receive additional remuneration for their services on the Board.

3.5. Meetings of the Board and Board Committees

During the financial year 2017-18, 9 Board meetings (2 out of session), 4 Board Audit & Risk Committee meetings, 4 Board People, Health & Safety Committee meetings, 5 Board Innovation Fund Sub-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 & Risk Committee		CSIRO Board People, Health & Safety Committee		CSIRO Board People Innovation Fund Sub-Committee		CSIRO Board Excellence Committee	
	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended
Michele Allan	9	7	2	1	-	4	-	1	4	4
Edwina Cornish	9	7	4	4	-	4	5	5	4	4
Shirley In't Veld	9	8	4	4	4	4	5	5	-	3
David Knox	9	6	-	1	4	4	5	5	4	3
Tanya Monro	9	8	-	3	4	4	-	1	4	3
Hutch Ranck	9	8	-	1	3	3	-	-	-	2
Peter Riddles	9	9	4	3	-	4	5	4	4	4
David Thodey	9	9	-	4	-	4	-	5	-	4
Drew Clarke	9	9	2	2	3	4	-	2	-	4
Larry Marshall	9	9	-	4	-	4	-	5	-	4

3.6. Related Party Disclosures

(a) Controlled Entities

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.

WLAN is a small proprietary company limited by shares, which are solely held by CSIRO. The principal activity of WLAN is to provide services to CSIRO. WLAN was established in 2005 and is anticipated to go through voluntary deregistration in 2018-19.

The 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.

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.

As part of the National Innovation and Science Agenda announced by the Australian Government in December 2015, CSIRO has established an Innovation Fund 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 eight entities whose purpose is to manage and operate the Fund. These entities 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. It was established in January 2017.
- CSIRO Management Partnership Pty LP is an incorporated limited partnership formed under the Partnership Act 1892 (NSW). It was established in January 2017 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 Pty 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.
- 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. It will also act as the trustee of CSIRO Innovation Holding Trust that was established in July 2018.
- 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 and acts as Manager of 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.
- 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.

All of the above entities are under the sole control of the CSIRO as at 30 June 2018. The above entities (with the exception of CSIRO Financial Services Pty Ltd and CSIRO Innovation 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

The entity is an Australian Government controlled entity. Related parties to this entity 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 the entity, 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	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Quantifiable Contingencies				
Contingent assets				
Insurance claims	**1,417**	1,808	**1,417**	1,808
Bank guarantees received from suppliers	**20,834**	20,689	**20,834**	20,689
Total contingent assets	**22,251**	22,497	**22,251**	22,497
Contingent liabilities				
Estimated legal claims	**-**	-	**-**	-
Total contingent liabilities	**-**	-	**-**	-
Total net contingent asset/(liability)	**22,251**	22,497	**22,251**	22,497

Depending on the materiality of risks involved with certain commercial transactions, CSIRO has requested bank guarantees where necessary to mitigate such risks, notably where substantial advance payments were made. Estimated legal claims are those arising from employment, motor vehicle accidents, commercial and patent disputes. The Group has denied liability and is defending the claims.

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	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 4.2A: Categories of financial instruments				
Financial Assets				
Available for sale financial assets				
Investments	**77,516**	36,212	**98,714**	69,821
Loans and receivables				
Cash at bank	**94,769**	129,641	**13,974**	31,071
Term deposits	**226,878**	170,226	**170,000**	120,000
Receivable for goods and services	**74,406**	76,167	**73,951**	72,495
Other receivables	**5,838**	3,221	**3,251**	712
Carrying amount of financial assets	**479,407**	415,467	**359,890**	294,099
Financial Liabilities				
Finance lease liabilities	**31,968**	37,755	**31,968**	37,755
Trade creditors	**83,844**	73,590	**82,112**	70,661
Research revenue received in advance	**118,268**	105,734	**118,268**	105,734
Deposits	**12,315**	5,178	**12,336**	8,345
Other creditors	**24,064**	23,509	**18,093**	19,075
Carrying amount of financial liabilities	**270,459**	245,766	**262,777**	241,570

Accounting Policy

Financial Assets

CSIRO classifies its financial assets in the following categories: available for sale financial assets and loans and receivables. The classification depends on the nature and the purpose of financial assets and is determined at the time of initial recognition. Financial assets are recognised and derecognised upon trade date.

Available-for-Sale Financial Assets

Available-for-sale financial assets are non-derivatives that are either designated in this category or not classified in any of the other categories. Available-for-sale financial assets are recorded at fair value. Gains and losses arising from changes in fair value are recognised directly in the reserves (equity) with the exception of impairment losses. Interest is calculated using the effective interest method and foreign exchange gains and losses on monetary assets are recognised directly in profit or loss. Where the asset is disposed of or is determined to be impaired, part (or all) of the cumulative gain or loss previously recognised in the reserve is included in the operating result for the period.

Effective Interest Method

The effective interest method is a method of calculating the amortised cost of a financial asset and of allocating interest income over the relevant period. The effective interest rate is the rate that exactly discounts estimated future cash receipts through the expected life of the financial asset or, where appropriate, a shorter period.

Income is recognised on an effective interest rate basis, except for financial assets that are recognised at fair value through profit and loss.

Fair value of Investments in Listed Companies

The fair value of investments in listed companies has been determined by reference to their closing bid price at the reporting date.

Fair value of Investments in Unlisted Companies

For investments in unlisted companies where there is no readily available market pricing for the equity instruments, 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 (IPEV) Guidelines'.

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.

In addition, independent valuations are performed as at reporting date for unlisted companies that are considered to have a material impact on CSIRO's investment portfolio.

Investments in special purpose entities are either valued at cost or 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 no 'active market' for these equity investments. CSIRO is a long-term shareholder and is unlikely to dispose of its interest in these investments.

Loans and Receivables

Trade receivables, loans and other receivables that have fixed or determinable payments that are not quoted in an active market, are classified as 'loans and receivables'. Loans and receivables are measured at amortised cost using the effective interest method less impairment. Interest is recognised by applying the effective interest rate. All trade and other receivables are expected to be recovered in no more than 12 months.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period.

Financial assets held at amortised cost- Where there is objective evidence that an impairment loss has been incurred for loans and receivables, the amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows discounted at the asset's original effective interest rate. The carrying amount is reduced by way of an allowance account. The loss is recognised in the Statement of Comprehensive Income.

Available-for-sale financial assets– Where there is objective evidence that an impairment loss on an available-for-sale financial asset has been incurred, the amount of the difference between its cost, less principal repayments and amortisation, and its current fair value, less any impairment loss previously recognised in expenses, is transferred from equity to the Statement of Comprehensive Income.

Available-for-sale financial assets (held at cost)- Where there is objective evidence that an impairment loss has been incurred, the amount of the impairment loss is the difference between the carrying amount of the asset and the present value of the estimated future cash flows discounted at the current market rate for similar assets.

Financial Liabilities

Financial liabilities are recognised and derecognised upon trade date. 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).

	Consolidated		CSIRO	
	2018	2017	**2018**	2017
	$'000	$'000	**$'000**	$'000
Note 4.2B: Net income and expense from financial assets				
Cash at bank and term deposits				
Interest revenue	**10,572**	8,752	**7,944**	6,264
Net gain from financial assets	**10,572**	8,752	**7,944**	6,264

Note 4.2C: Net income and expense from financial liabilities				
Finance leases				
Interest expense	**1,562**	2,332	**1,547**	2,321
Net loss from financial liabilities	**1,562**	2,332	**1,547**	2,321

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CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
4.3. Fair value measurement

Significant 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:

- The fair value of properties classified as 'properties held for sale' has been taken to be the market value (level 1 inputs), and for 'investment properties' has been taken to be the market value (level 2 inputs), of similar properties as determined by an independent valuer;
- The fair value of land which will continue to be used 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 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 1 and 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.

Note 4.3A: Fair value measurement

	Fair value measurements at the end of the reporting period	
	2018	**2017**
	$'000	**$'000**
Financial assets		
Available for sale financial assets	**77,516**	36,212
Total financial assets	**77,516**	36,212
Non-financial assets		
Land	**440,600**	384,489
Buildings	**1,185,007**	1,191,397
Plant and equipment	**548,632**	572,400
Investment Properties	**49,697**	51,110
Properties Held For Sale	**5,200**	5,200
Heritage and cultural	**4,463**	4,206
Total non-financial assets	**2,233,599**	2,208,802
Total fair value measurements (assets)	**2,311,115**	2,245,014

The above disclosure represents the consolidated financial position of the Group.

5. Other information

5.1. Cooperative Research Centres (CRCs)

All CRCs have been classified as joint operations as the purpose is for the pursuit of collaborative scientific research where participants share in the scientific outcomes and outputs of the CRCs. In the event that CRC research results in a move to commercialisation, a separate legal entity is established and the CSIRO's share of the new entity is treated either as subsidiary, joint venture or associate in the Statement of Financial Position as appropriate.

CSIRO's total cash and in-kind contribution (e.g. staff and use of assets) to CRCs from its own resources was $10.8 million and to CRC-P's $2.7 million. Contributions made by CSIRO are expensed as incurred and these are included in the Statement of Comprehensive Income.

CSIRO is a participant in the following CRCs as at 30 June 2018.

Name of CRC	Scheduled Termination Date
Alertness Safety & Productivity CRC	30/06/20
Antarctic Climate and Ecosystems CRC	30/06/19
Bushfire and Natural Hazards CRC	29/03/19
Cancer Therapeutics CRC	30/06/20
Contaminated Assessment and Remediation of the Environment (CRC for CARE)	30/06/20
Cyber Security CRC	31/12/24
Deep Exploration Technologies CRC	30/06/18
High Integrity Australian Pork CRC	30/06/19
Innovative Manufacturing CRC	30/06/21
Low Carbon Living CRC	30/06/19
Mental Health CRC	30/06/18
Optimising Resource Extraction CRC	30/06/21
Plant Biosecurity CRC	30/06/18
Rail Manufacturing CRC	30/06/21

CSIRO is a participant in the following CRC-Ps as at 30 June 2018.

Name of CRC-P	Scheduled Termination Date
Developing Sustainable Cropping Systems for cotton, grains and fodder	15/11/20
New pastures to increase livestock productivity across the north	30/09/20
Large Area Glass Perovskite CRC-P	30/09/18
Oventus CRC-P (targeted therapy for sleep apnoea)	31/03/20
Printed Solar Films CRC-P	30/06/18

Accounting Policy

Joint Operations – Cooperative Research Centres (CRCs)

The proportionate interests in CRCs regarded as joint operations are disclosed in the financial statements under appropriate headings. Their primary source of funding is from the Australian Government and funding is progressively drawn down over the life of the CRCs and distributed to participants, including CSIRO and universities, for research and development purposes. CSIRO's contributions to the CRCs are expensed as incurred and funds received from CRCs are recognised as revenue to the extent that work has been performed in the Statement of Comprehensive Income. CSIRO has been a participant in 14 CRCs and 5 CRC-P's during the financial year.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

5.2. Monies Held in Trust

	2018 $'000	2017 $'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.	**404**	377
The Elwood and Hannah Zimmerman Trust Fund - established to fund weevil research and the curation of the Australian National Insect Collection (ANIC) weevil collection.	**4,591**	4,821
The Schlinger Trust - established to research the taxonomy, biosystematics, general biology and biogeography of Australasian Diptera conducted by the Australian National Insect Collection.	**2,341**	2,307
Total monies held in trust as at 30 June	**7,336**	7,505

Summary of movements:	**McLennan $'000**	**Zimmerman $'000**	**Schlinger $'000**	**Total $'000**
Balance as at 1 July 2017	**377**	**4,821**	**2,307**	**7,505**
Adjustments	**-**	**(7)**	**-**	**(7)**
Interest and distribution adjustments	**27**	**5**	**34**	**66**
Expenditure in the period	**-**	**(228)**	**-**	**(228)**
Balance as at 30 June 2018	**404**	**4,591**	**2,341**	**7,336**

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
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 the 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.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

6. Budgetary Reports and Explanations of Major Variances

The following provides a comparison of the original budget as presented in the 2017-18 Portfolio Budget Statements to the actual outcome reported for 2017-18. 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 2018

	Actual	Consolidated Original Budget	Variance
	2018	**2018**	2018
	$'000	**$'000**	$'000
NET COST OF SERVICES			
Expenses			
Employee benefits	**699,295**	**731,009**	(31,714)
Suppliers	**443,153**	**470,541**	(27,388)
Depreciation and amortisation	**181,609**	**170,236**	11,373
Finance costs	**1,562**	**2,386**	(824)
Write-down and impairment of assets	**7,003**	**-**	7,003
Foreign exchange losses	**828**	**-**	828
Loss on revaluation of investment properties	**1,413**	**-**	1,413
Losses from asset sales	**15,087**	**-**	15,087
Total expenses	**1,349,950**	**1,374,172**	(24,222)
Own-Source Income			
Own-source revenue			
Sale of goods and rendering of services	**384,554**	**441,448**	(56,894)
Interest	**10,572**	**7,373**	3,199
Rental income	**11,001**	**-**	11,001
Royalties and licence fees	**43,175**	**43,643**	(468)
Other revenues	**35,864**	**18,824**	17,040
Sale of equity investments and intellectual property	**1,943**	**-**	1,943
Total own-source revenue	**487,109**	**511,288**	(24,179)
Gains			
Net gain from sales of assets	**66**	**6,000**	(5,934)
Gain on revaluation of investment properties	**-**	**-**	-
Total gains	**66**	**6,000**	(5,934)
Total own-source income	**487,175**	**517,288**	(30,113)
Net cost of services	**(862,775)**	**(856,884)**	(5,891)
Revenue from Government	**793,549**	**793,549**	-
Surplus on continuing operation	**793,549**	**793,549**	-
Surplus/(Deficit) attributable to the Australian Government	**(69,226)**	**(63,335)**	(5,891)
OTHER COMPREHENSIVE INCOME			
Items not subject to subsequent reclassification to net cost of services			
Increase/(decrease) in asset revaluation reserves	**110,554**	**-**	110,554
Items subject to subsequent reclassification to net cost of services			
Increase/(decrease) in other reserves	**9,853**	**-**	9,853
Total other comprehensive income	**120,407**	**-**	120,407
Total comprehensive income/(loss) attributable to the Australian Government	**51,181**	**(63,335)**	114,516

Statement of Financial Position
as at 30 June 2018

	Actual	Consolidated Original Budget	Variance
	2018	**2018**	**2018**
	$'000	**$'000**	**$'000**
ASSETS			
Financial Assets			
Cash and cash equivalents	**321,647**	**199,320**	122,327
Trade and other receivables	**84,165**	**60,815**	23,350
Investments accounted for using the equity method	**-**	**-**	-
Other investments	**77,516**	**73,486**	4,030
Total financial assets	**483,328**	**333,621**	149,707
Non-Financial Assets			
Land and buildings	**1,625,607**	**1,522,268**	103,339
Plant and equipment	**548,632**	**560,001**	(11,369)
Heritage and cultural	**4,463**	**4,206**	257
Intangibles	**16,573**	**12,069**	4,504
Investment properties	**49,697**	**50,222**	(525)
Inventories	**1,440**	**1,384**	56
Other non-financial assets	**44,295**	**48,902**	(4,607)
Total non-financial assets	**2,290,707**	**2,199,052**	91,655
Properties held for sale	**5,200**	**-**	5,200
Total assets	**2,779,235**	**2,532,673**	246,562
LIABILITIES			
Payables			
Suppliers	**83,844**	**23,464**	60,380
Other payables	**142,332**	**151,514**	(9,182)
Total payables	**226,176**	**174,978**	51,198
Interest Bearing Liabilities			
Leases	**31,968**	**33,919**	(1,951)
Deposits	**12,315**	**5,872**	6,443
Total Interest bearing liabilities	**44,283**	**39,791**	4,492
Provisions			
Employee provisions	**218,956**	**206,682**	12,274
Provision for remediation	**29,815**	**25,154**	4,661
Total provisions	**248,771**	**231,836**	16,935
Total liabilities	**519,230**	**446,605**	72,625
Net assets	**2,260,005**	**2,086,068**	173,937
EQUITY			
Contributed equity	**290,954**	**287,623**	3,331
Asset revaluation reserves	**1,492,286**	**1,384,753**	107,533
Other reserves	**15,229**	**-**	15,229
Retained surplus	**461,536**	**413,692**	47,844
Total equity	**2,260,005**	**2,086,068**	173,937

Statement of Changes in Equity

for the period ended 30 June 2018

	Retained earnings			Asset revaluation reserve			Other reserves			Contributed equity/capital			Total equity		
	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance
	2018	**2018**	2018	**2018**	**2018**	2018	**2018**	**2018**	2018	**2018**	**2018**	2018	**2018**	**2018**	2018
	$'000	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000
Opening balance	**530,762**	**475,673**	55,089	**1,381,732**	**1,387,550**	(5,818)	**5,376**	**(1,704)**	7,080	**280,954**	**279,007**	1,947	**2,198,824**	**2,140,526**	58,298
Comprehensive income															
Other comprehensive income	-	-	-	**110,554**	-	110,554	**9,853**	-	9,853	-	-	-	**120,407**	-	120,407
Surplus/(deficit) for the period	**(69,226)**	**(63,335)**	(5,891)	-	-	-	-	-	-	-	-	-	**(69,226)**	**(63,335)**	(5,891)
Total comprehensive income	**(69,226)**	**(63,335)**	(5,891)	**110,554**	-	110,554	**9,853**	-	9,853	-	-	-	**51,181**	**(63,335)**	114,516
Other Movements (NICTA Transfer)	-		-			-			-	-		-	-	-	-
Contributions by owners															
Equity injection	-	-	-	-	-	-	-	-	-	**10,000**	**10,000**	-	**10,000**	**10,000**	-
Contributions by owners – other	-	**1,354**	(1,354)	-	**(1,093)**	1,093	-	-	-	-	**(1,384)**	1,384	-	**(1,123)**	1,123
Closing balance	**461,536**	**413,692**	47,844	**1,492,286**	**1,386,457**	105,829	**15,229**	**(1,704)**	16,933	**290,954**	**287,623**	3,331	**2,260,005**	**2,086,068**	173,937

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

Cash Flow Statement

for the period ended 30 June 2018

	Consolidated		
	Actual	Original Budget	Variance
	$'000	$'000	$'000
OPERATING ACTIVITIES			
Cash received			
Receipts from Government	**793,549**	**793,549**	-
Goods and services	**502,153**	**483,417**	18,736
Interest	**9,833**	**7,600**	2,233
Net GST received	**14,947**	**(19)**	14,966
Deposits	**7,138**	**-**	7,138
Other	**-**	**18,824**	(18,824)
Total cash received	**1,327,620**	**1,303,371**	24,249
Cash used			
Employees	**697,537**	**729,065**	(31,528)
Suppliers	**486,039**	**468,600**	17,439
Finance costs	**1,562**	**2,386**	(824)
Other	**-**	**1,817**	(1,817)
Total cash used	**1,185,138**	**1,201,868**	(16,730)
Net cash from operating activities	**142,482**	**101,503**	40,979
INVESTING ACTIVITIES			
Cash received			
Proceeds from sales of property, plant and equipment	**5,090**	**46,300**	(41,210)
Proceeds from sales of equity investments and intellectual property	**5,391**	**-**	5,391
Total cash received	**10,481**	**46,300**	(35,819)
Cash used			
Purchase of property, plant and equipment	**116,631**	**122,803**	(6,172)
Equity investments	**18,696**	**10,000**	8,696
Other selling costs	**69**	**-**	69
Total cash used	**135,396**	**132,803**	2,593
Net cash from (used by) investing activities	**(124,915)**	**(86,503)**	(38,412)
FINANCING ACTIVITIES			
Cash received			
Contributed equity	**10,000**	**10,000**	-
Total cash received	**10,000**	**10,000**	-
Cash used			
Finance leases	**5,787**	**3,835**	1,952
Total cash used	**5,787**	**3,835**	1,952
Net cash from financing activities	**4,213**	**6,165**	(1,952)
Net increase (decrease) in cash held	**21,780**	**21,165**	615
Cash and cash equivalents at the beginning of the reporting period	**299,867**	**178,155**	121,712
Cash and cash equivalents at the end of the reporting period	**321,647**	**199,320**	122,327

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 2017-18 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.

It should be noted that the original budget was prepared before the 2016-17 actual figures could be known. As a consequence the opening balance of the 2017-18 Statement of Financial Position needed to be estimated and in some cases, variances between 2017-18 actuals and budget numbers can be, at least in part, attributed to unanticipated movements in the prior period figures. 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

CSIRO's *employee benefits* were below budget, driven mainly by budgeted contractor costs not being utilised.

Write-down and impairment of assets and *losses from asset sales* were not foreseen at the time of preparing the budget.

The original budget for s*ale of goods and rendering of services* revenues included *rental income* and a portion of *other revenues*, which are on separate lines in the actual figures. Additionally, some asset sales have been delayed, resulting in a lower *net gain from asset sales* than budgeted.

Statement of Financial Position

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 accounting treatment between the two, resulting in the budget containing the Innovation Fund investment as an *Investment accounted for using the equity method*, while the Financial Statements account for this investment in the consolidation as *Cash and cash* equivalents held by a controlled entity.

Land and buildings and *intangibles* have increased in value based on a formal valuation report. This increase was not foreseen at the time of preparing the budget.

Properties held for sale was expected to be $0 at the time of the budget due to the expectation that the sale of the CSIRO Belmont site be finalised by June 2018, however, the sale has been delayed until late 2018-19.

Cash Flow Statement

Variances relating to cash flows occur because of the factors detailed under Income Statement and Balance Sheet.

Argo floats provide real-time observations of the oceans around Australia. A new fleet of floats funded by the Science and Industry Endowment Fund will address substantial gaps in regions of interest to Australia.

Part 6
Science and Industry Endowment Fund

TRUSTEE'S REPORT

As rapid global change disrupts, reshapes and creates new Australian industries, our Science and Industry Endowment Fund (SIEF) continues to strengthen the translation of world-class Australian research into cutting-edge industrial advantages, in line with national priorities. This year, SIEF expanded its role with two new endowments, broadened its portfolio with a new funding program, and grew its investments in breakthrough innovation, strengthened by co-investment. I'm so pleased to present this 2017–18 report of SIEF's important role in our national innovation system.

In June 2017, the NSW Government recognised SIEF's critical role and significant impact by making an endowment to create a science, technology, engineering and mathematics (STEM) initiative in New South Wales. Titled Generation STEM, the initiative is designed to increase the supply of STEM skilled labour to meet the current and future needs of the state.

CSIRO was enlisted to manage the activities under the fund, to be delivered under an agreed set of phases, and began the first Planning Phase on 1 July 2017. During this time, a Program Director, an Impact Evaluation Officer and a Consultative Council consisting of seven members were appointed to the initiative. Research and a current-state analysis have been conducted to understand the existing market and inform the strategic plan for the initiative and the first three-year operational plan.

In June 2018, CSIRO made a fourth gift to SIEF of $10 million, specifically to extend the Experimental Development Program (EDP) for up to eight more years, from 1 July 2018. We also made six new grants to usher research through to commercial impact under the EDP, aiming to increase Australian productivity and competitiveness. We secured additional funding by supplementing $9.4 million from SIEF with $10.5 million in co-investment, growing the sustainability of the Fund through an increased role for our partners. The projects include the optimisation of commercial influenza vaccine production and viable alternatives to the use of toxic cyanide for gold recovery. The EDP is now well established as an important funding option for researchers seeking to progress technology development to a stage suitable for attracting commercial investment and market uptake.

This year, we introduced the Medium Equipment Program (MEP) to the SIEF portfolio, addressing a funding gap for equipment in the range of $500,000 to $4 million. In addition to supporting capability and capacity for world-class science, the equipment must encourage collaboration nationally, internationally and with industry. So far, almost $10 million has been awarded for 13 pieces of research equipment across diverse areas of research, from agriculture and marine observation to biomedical science and cyber security.

Thank you to our advisory bodies and to the large number of reviewers who generously contribute their time and expertise to SIEF, particularly providing industry and commercialisation counsel to the EDP panels. The more voices we have in both SIEF and the wider STEM community, the stronger our innovation will be. From growing the future STEM workforce, to broadening the scope of our portfolio, to maintaining the rigour and integrity of our investments, SIEF continues to strengthen Australia's response to the rapidly changing world and playing a critical role in its future prosperity.

Experimental Development Program projects

Hovermap

In 2016, the Hovermap project led by CSIRO received twelve months of EDP funding to extend the application of drone technology. Most industries use drone technology that relies on Global Positioning System (GPS) technology and is therefore incapable of flying autonomously indoors or underground where GPS technology is inaccessible. The funding was granted to establish an early adopter program for testing the hardware and software components that enable omni-directional 3-D sensing and LiDAR based mapping without the need for GPS technology. The project accelerates the development of Hovermap technology, builds market awareness of the capability and paves the way for successful commercialisation.

The Hovermap drone payload can fly autonomously in GPS-denied environments to create 3-D maps.

Smart Windows

A SIEF-funded collaboration between CSIRO, Monash, Queensland University of Technology and Australian company iGlass is developing a new and improved 'smart glass' with automatically controlled optical properties, such as light transmission and visibility. This project looks to overcome known challenges associated with product life and durability to release the potential of such devices for application in automotive component manufacture (e.g. sunroofs) and building design (e.g. windows), with a projected potential global market value of approximately $300 million by 2025.

Medium Equipment Program

cGMP Protein Facility

SIEF funding will be used with co-investment from CSIRO, Monash University, two Australian firms, and one multinational company to build a flexible and multipurpose cGMP facility, in synergy within an ecosystem of established research facilities, to enable rapid and effective translation of biological discoveries into high-value clinical entities.

The equipment will allow process development and large-scale production of biologicals (such as vaccines, monoclonal antibodies, antigens, growth factors and stem cells) under the most stringent regulatory (cGMP) standards, thus enabling their testing in pre-clinical and Phase-I trials worldwide. This unique new capability will provide a collaborative entry point for translating the research undertaken in Australian hospitals, universities, biomedical institutes and SMEs into clinical development.

Argo Floats

The international Argo program is revolutionising our ability to observe, understand and sustainably use the oceans, with over 4,000 Argo floats deployed throughout the world's oceans. Each Argo float is an autonomous instrument that collects vertical profiles of temperature, salinity and pressure over the top 2,000m of the ocean and transmits the data in real time. In collaboration with several Australian research entities, SIEF funding will enable a new fleet of at least 140 latest-generation Argo floats to be deployed to complement the existing Australian array of 500. The new floats will address substantial gaps in regions of crucial interest to Australia, including waters off the east, west and north-west coasts of Australia and the Southern Ocean, thus realising the vision of an integrated sensor network in the oceans around Australia.

CSIRO Recombinant Protein Production Facility (RPPF) staff using sterile microbiological medium under simulated manufacturing conditions, to validate aseptic procedures.

SIEF advisory bodies

CSIRO Gift Advisory Council Members

Prof Alan Robson (Chair)
Dr Peter Riddles (Chair, EDP Review Panels)
Mr Nigel Poole
Dr Ezio Rizzardo
Prof Margaret Sheil
Prof Tom Spurling

Generation STEM Consultative Council Members

Prof Brian Boyle (Chair)
Ms Maile Carnegie
Ms Tish Creenaune / Ms Jacki Hayes
Ms Gail Fulton
Mr Tom McGinness
Mr Graeme Plato

Dr Larry Marshall
SIEF Trustee

SIEF PERFORMANCE REPORT

The Science and Industry Endowment Fund (SIEF) is a separately constituted trust under the *Science and Industry Endowment Act 1926*. The Fund invests in science that addresses issues of national economic, industrial, environmental and cultural priority and contributes to Australia's sustainable future, by providing assistance:

- to persons engaged in scientific research
- in the training of students in scientific research
- CSIRO Chief Executive Dr Larry Marshall is Trustee of the SIEF, and awards funding to parties across the national innovation system. The Trustee seeks independent advice and recommendations on funding of proposals. CSIRO manages the Fund on behalf of the Trustee.

SIEF was rejuvenated by a gift from CSIRO of $150 million, resulting from the Fast WLAN patent litigation in 2009 (CSIRO Gift). In June 2018, CSIRO supplemented this with an additional $10 million, specifically to extend the Experimental Development Program for up to eight more years, from 1 July 2018. Under the CSIRO Gift, some of the programs operate on a competitive basis, others by invitation on the basis of identified needs – all applications are considered against rigorous merit criteria. The CSIRO Gift to SIEF funds the:

- Experimental Development Program (EDP)
- Joint CSIRO–Macquarie University Chair in Wireless Communications
- Promotion of Science Fellowships and Scholarships Program (competitive)
- Research Infrastructure Program, including the Medium Equipment Program
- Research Projects Program (competitive)
- SIEF–AAS Fellowships to the Lindau Nobel Laureate meeting and the Heidelberg Laureate Forum, facilitated by the Australian Academy of Science (competitive)
- SIEF STEM+ Business Fellowships, facilitated by CSIRO
- Special Research Program.

In 2017, the NSW Department of Industry endowed $25 million over 10 years to SIEF, with the aim of attracting, supporting, retaining and training NSW students in the areas of STEM – thus increasing the supply of STEM-engaged students for the future workforce. CSIRO Education and Outreach facilitates the development and implementation of programs for school students and those engaged in higher and vocational education.

The contribution of research to solving issues of national importance can only be measured long term, but SIEF has developed several key performance indicators for its programs. As the funds available for allocation under the CSIRO Gift diminish and fewer new projects are commenced, some performance results will not change from previous years. New performance measures for the NSW STEM Initiative will be added once the program is fully established and operational.

This year, the CSIRO Gift programs continued to perform well. Table 6.1 provides an overview of the evidence against each performance criterion as published in the Portfolio Budget Statements, followed by a more detailed analysis and evidence.

TABLE 6.1: SUMMARY OF PERFORMANCE

PERFORMANCE CRITERION	TARGET	RESULT	
Evidence of outcomes and impacts of funded projects as demonstrated by case study impact assessment, independent reviews and evaluations	Minimum 1 case study	G	An independent case study of the *Distal Footprints of Giant Ore Systems: UNCOVER Australia Project* has found that the Project has developed an innovative approach that could allow resource discovery rates to increase significantly, even in areas where the cover over the top of the potential source is relatively deep. It has also supported the further development of a research concentration in Perth that is leading to additional investment in Western Australia's geological research community.
Proportion of research projects involving more than one organisation	>93% projects involve more than one organisation	G	SIEF has reached its target of 93% of projects involving more than one organisation. Since 2009, SIEF has successfully facilitated collaboration among 105 different organisations formally involved in SIEF-supported research. Notably, the STEM+ Business program is highly cooperative, with collaborators representing a mix of Australian universities, governments, industry and SMEs.
Utilisation of the research infrastructure as measured through time allocations	>60% operational time used, 20% usage in collaborative projects	G	Overall utilisation of scheduled operating time has reached 60% for SIEF-funded Research Infrastructure equipment that has been fully commissioned. Usage in collaborative projects is limited at this stage, but will increase as equipment is progressively installed and commissioned.

Green shading indicates positive progress for the year and the target has been achieved.

Evidence of outcomes and impacts of funded projects

In early 2018, ACIL Allen Consulting updated an earlier case study of the economic, environmental and social benefits of the SIEF-funded Research Project *The Distal Footprints of Giant Ore Systems: UNCOVER Australia Project (RP04- 063)*, a collaboration among CSIRO, the University of Western Australia, Curtin University and the Geological Survey of Western Australia. The case study[30] found that the project has developed an innovative approach that could allow resource discovery rates to increase significantly, even in areas where the cover over the top of the potential source is relatively deep. Direct economic benefits will flow from the potentially increased economic activity generated by new mineral exploration opportunities in previously unexplored areas. The project has also encouraged a research concentration in Perth that is leading to additional investment in Western Australia's geological research community, facilitated by the information and techniques emerging from the project. While the results of the project will initially be applied in Western Australia, the information and techniques emerging from it may promote investment opportunities for explorers in other mining regions.

A cost-benefit analysis is illustrative of the potential impact of this project. From early 2012 to late 2014, on average approximately 1,411 million metres of mineral exploration holes were drilled in Western Australia every year. The average cost of this drilling was $382 per metre. It is assumed that the SIEF-funded research results in miners having access to information that allows them to more accurately target their drilling activities, and that this results in a 1 per cent reduction in the distance drilled per year from 2021 to 2022 onwards, and that 50 per cent of these benefits are attributable to SIEF. Using conservative net present value calculation, the benefit cost ratio of the project is 4.14, increasing to 20.71 if the SIEF-funded research enables a 5 per cent reduction in drilling distance per year in Western Australia.

Proportion of projects involving more than one organisation

Studies of innovation have shown that collaboration is critical for improving the effectiveness of translating research outputs into business innovation that delivers economic, environmental and social benefits. Collaboration helps Australian industry gain marketplace advantage by fostering creativity, developing new skills, transferring knowledge, managing risk and attracting aspiring investors and partners. One of SIEFs primary objectives is to improve collaboration across the Australian Innovation System.

Ninety-three per cent of SIEF-supported activities involve more than one organisation and these research relationships foster communication, interaction and collaboration. Since 2009, 105 different organisations have been formally involved in one or more SIEF-funded projects, representing Australian universities, governments, industry, SMEs and overseas organisations. SIEF-funded activities support collaboration and innovation through a range of activities including the commercial-focused Experimental Development Program and by providing access to the latest-generation research technology via investments in the Research Infrastructure and Medium Equipment Program.

Co-authorship of publications reinforces collaboration and demonstrates that all contributing parties recognise the value of the research activity and its outputs. The number of publications emerging directly from SIEF-funded activity has been increasing over the life of SIEF-funded programs. From 2016–17 to 2017–18, publications output increased by 37 per cent, reflecting the maturity of the research projects and the strength of the collaborative relationships they established.

30 The ACIL Allen case study is available at http://www.sief.org.au/Documents/RP/SIEF%20Impact%20Evaluation%20-%20Distal%20Footprints%20-%20May%202018.pdf.

Utilisation of the research infrastructure as measured through time allocations

Since 2013, SIEF has invested $40.4 million in three major Research Infrastructure projects with the aim of developing and maintaining leading-edge research infrastructure and fostering collaboration across the national innovation system. These projects are the Advanced Resource Characterisation Facility in Perth, Monash MedTech (formerly, the Biomedical Translation Facility) in Melbourne and the National Agricultural and Environmental Sciences Precinct in Canberra. The sophisticated and complex sets of equipment funded under the Research Infrastructure projects represent major infrastructure investments and have progressively been installed, tested and commissioned, with several now online. Initial results suggest that utilisation of scheduled operating time is accelerating and is on track to reach targets set for two years post-commissioning. Notable highlights include 100 per cent utilisation of the Perth nanoSIMs and 70 per cent utilisation of the AtomProbe within months of commissioning. Mass spectrometry equipment in Canberra has also been in constant use with over 90 per cent utilisation. For the MR-PET and Hot Lab at Clayton, several clinician-researcher and industry-researcher projects are underway. Other collaborative projects are pending outcomes of joint grant applications and/or the full commissioning of equipment.

An independent external assessment of the performance of SIEF[31] published in 2017 noted that SIEF Research Infrastructure investment has helped catalyse a further investment of close to $174 million from six other organisations (four universities, CSIRO and the Pawsey Centre). In effect, SIEF's investment in these activities encouraged four-and-a-half times more investment by other parties.

The SIEF Medium Equipment Program (MEP) was launched in 2017 and is designed to address a gap in funding for equipment priced in the approximate range of $50,000 to $4 million. Projects funded under this Program are in early stages of procurement and installation in various research sites across Australia, and include cutting-edge equipment in acoustics, geosciences, digital agriculture research, genomics, oceanography, signal processing and industrial chemistry.

31 The review is available at http://www.sief.org.au/Documents/Impact%20Review/3.%20SIR%20-%20Appendix%202%20An%20Evaluation%20of%20SIEFs%20Performance__PUBLISHED.pdf

INDEPENDENT AUDITOR'S REPORT

To the Trustee of the Science and Industry Endowment Fund

Opinion

In my opinion, the financial report of the Science and Industry Endowment Fund for the year ended 30 June 2018 gives a true and fair view of the financial position of the Science and Industry Endowment Fund as at 30 June 2018 and its financial performance and cash flows for the year then ended in accordance with Australian Accounting Standards.

The financial report of the Science and Industry Endowment Fund, which I have audited, comprise the following statements as at 30 June 2018 and for the year then ended:

- Statement by Trustee and Chief Finance Officer of Commonwealth Scientific and Industrial Research Organisation (CSIRO) as Service Provider to the Science and Industry Endowment Fund;
- 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 report, 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 Report* section of my report. I am independent of the Science and Industry Endowment Fund in accordance with the relevant ethical requirements for financial report 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* to the extent that they are not in conflict with the *Auditor-General Act 1997* (the Code). 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.

Trustees's Responsibility for the Financial Report

The Trustee of the Science and Industry Endowment Fund is responsible for the preparation of the financial report that gives a true and fair view in accordance with Australian Accounting Standards. The Trustee is also responsible for such internal control as they determine is necessary to enable the preparation of the financial report that gives a true and fair view and that is free from material misstatement, whether due to fraud or error.

In preparing the financial report, the Trustee is responsible for assessing the Science and Industry Endowment Fund's ability to continue as a going concern, disclosing matters related to going concern, as applicable and using the going concern basis of accounting unless the Trustee either intends to liquidate the entity or to cease operations, or has no realistic alternative but to do so.

Auditor's Responsibilities for the Audit of the Financial Report

My objective is to obtain reasonable assurance about whether the financial report as a whole is 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

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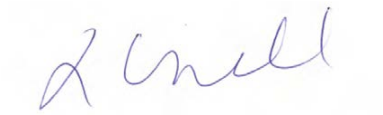
influence the economic decisions of users taken on the basis of the financial report.

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 report, 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's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Trustee;
- conclude on the appropriateness of the Trustee'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'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 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 report represents the underlying transactions and events in a manner that achieves fair presentation.

I communicate with those charged with governance 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



Lesa Craswell
Executive Director

Delegate of the Auditor-General

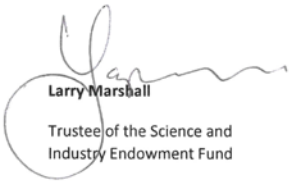
Canberra
26 July 2018

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT BY TRUSTEE AND CHIEF FINANCE OFFICER OF COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO) AS SERVICE PROVIDER TO THE SCIENCE AND INDUSTRY ENDOWMENT FUND

In our opinion, the attached financial report for the year ended 30 June 2018 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 give a true and fair view of the financial position of the Science and Industry Endowment Fund as at 30 June 2018 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

26 July 2018

Tom Munyard

Chief Finance Officer of CSIRO as service provider to the Science and Industry Endowment Fund

26 July 2018

STATEMENT OF COMPREHENSIVE INCOME

For the period ended as at 30 June 2018

	Notes	2018	2017
		$	$
EXPENSES			
Scientific research grants	1	**18,632,420**	17,672,851
Service fee under Services Agreement with CSIRO		**352,072**	525,718
Consulting fees		**-**	178,891
Audit fees		**15,500**	15,000
Other fees		**450**	6
Total expenses		**19,000,442**	18,392,466
LESS:			
REVENUE			
NSW Government Endowment contribution	2	**-**	25,000,000
CSIRO Gift	2	**10,000,000**	-
Scientific grant program refunds		**-**	71,352
Interest	3	**1,697,666**	1,723,749
Total revenue		**11,697,666**	26,795,101
Net profit/ (deficit)		**(7,302,776)**	8,402,635
Other comprehensive income		-	-
Total comprehensive loss		**(7,302,776)**	8,402,635

The above statement should be read in conjunction with the accompanying notes.

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT OF FINANCIAL POSITION

For the period ended as at 30 June 2018

	Notes	2018	2017
		$	$
ASSETS			
Current assets			
Cash	4	**68,181,236**	75,804,536
Interest receivable		**702,647**	439,736
GST receivable		**199,054**	152,119
Other receivables		**-**	14,223
Total assets		**69,082,937**	76,410,614
LIABILITIES			
Payables			
Shared service fee payable		**87,819**	113,220
Accrued audit fee		**15,500**	15,000
Total payables		**103,319**	128,220
Total liabilities		**103,319**	128,220
Net assets		**68,979,618**	76,282,394
EQUITY			
Contributed equity		**200,000**	200,000
Retained surplus		**68,779,618**	76,082,394
Total equity		**68,979,618**	76,282,394

The above statement should be read in conjunction with the accompanying notes.

STATEMENT OF CHANGES IN EQUITY

For the period ended as at 30 June 2018

	Retained Surplus		Contributed Equity		Total Equity	
	2018	2017	**2018**	2017	**2018**	2017
	$	$	**$**	$	**$**	$
Opening Balance	**76,082,394**	67,679,759	**200,000**	200,000	**76,282,394**	67,879,759
Net profit/(deficit)	**(7,302,776)**	8,402,635	**-**	-	**(7,302,776)**	8,402,635
Closing Balance	**68,779,618**	76,082,394	**200,000**	200,000	**68,979,618**	76,282,394

The above statement should be read in conjunction with the accompanying notes

SCIENCE AND INDUSTRY ENDOWMENT FUND

CASH FLOW STATEMENT

For the period ended as at 30 June 2018

	Notes	2018	2017
		$	$
OPERATING ACTIVITIES			
Cash received			
NSW Government Endowment contribution		-	25,000,000
CSIRO GIFT		**10,000,000**	-
Scientific research grant refunds		-	111,832
Interest received		**1,434,755**	1,734,764
Net GST received		**1,850,933**	2,072,115
Total cash received		**13,285,688**	28,918,711
Cash used			
Payments to grantees		**20,516,065**	19,590,962
Other payments		**392,473**	658,529
Bank fees paid		**450**	4
Total cash used		**20,908,988**	20,249,495
Net cash provided/(used) by operating activities	5	**(7,623,300)**	8,669,216
Net increase/(decrease) in cash held		**(7,623,300)**	8,669,216
Cash at the beginning of the reporting period		**75,804,536**	67,135,320
Cash at the end of the reporting period		**68,181,236**	75,804,536

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 period ended as at 30 June 2018

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 CSIRO Chief Executive and it 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 then 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, 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. The total cash payments made in 2017-18 under the Deed of Gift was $18,354,389 (GST exclusive).

In June 2017, the NSW Government acting through the NSW Department of Industry provided a $25m endowment to SIEF to create the NSW Generation STEM Program. The program 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 in 2017-18 under the NSW Endowment was $656,283 (GST exclusive).

In June 2018, the CSIRO made a gift of $10m to the Fund. The gift is intended to be used for scientific research for the purposes of assisting Australian industry, 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 the Deed of Gift between the Trustee and CSIRO dated 15 October 2009.

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 and the NSW Generation STEM Program. The total payments made were $19,011,121. Note that this is payments exclusive of GST, per the terms of the deed.

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.* They have been prepared in accordance with Australian Accounting Standards, Australian Accounting Interpretations, and other authoritative pronouncements of the Australian Accounting Standards Board.

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.

Assets and liabilities are recognised in the Statement of Financial Position when, and only when, it is probable that future economic benefits will flow and the amounts of the assets or liabilities can be reliably measured.

Revenues and expenses are recognised in the Statement of Comprehensive Income when, and only when, the flow or consumption or loss of economic benefits has occurred and can be reliably measured.

The financial report is presented in Australian Dollars and values are rounded to the nearest dollar unless otherwise specified.

Significant Accounting Judgements and Estimates and New Accounting Standards

No accounting assumptions or estimates have been identified that have a significant impact on the amounts recorded in the financial statements.

The Fund has reviewed new standards, revised standards and interpretations/amending standards issued prior to the signing of the financial statements.

Events after the Reporting Period

SIEF is in discussions with National ICT Australia Limited (NICTA) to establish a program to fund scientific research in ICT technologies. At the time of signing the financial statements no deed of gift has been signed. The timing and amount of the gift from NICTA is not yet confirmed.

The Trustee is not aware of any other significant events occurring after the reporting date that could impact on the financial report.

Taxation

The Fund is exempt from all forms of taxation except GST.

SCIENCE AND INDUSTRY ENDOWMENT FUND

NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2018

Note 1 Scientific Research Grants

	2018	2017
	$	$
Macquarie University Joint Chair In Wireless Communication	**299,881**	288,347
Scholarships and Fellowships	**2,167,022**	6,068,600
Research Infrastructure Investment	**10,357,000**	5,706,000
Research Project Grants	**888,224**	3,755,107
Experimental Development Program	**4,270,293**	1,854,797
NSW Endowment Grant	**650,000**	-
Total	**18,632,420**	17,672,851

The Fund is a subsidiary entity of the Commonwealth Scientific and Industrial Research Organisation (CSIRO). For the 2017-18 financial year, the Fund has recognised $16m in grant expenses as transferred directly to CSIRO to support scientific research and infrastructure projects within CSIRO and/or collaborative projects with external organisations (2016-17: $12m).

Note 2 Contributions Revenue

Contributions are recognised as revenue when the Fund obtains control of the contribution and the amount of the contribution can be measured reliably. Contributions are recognised at fair value of the contributions received or receivable. In 2016-17, the Fund received $25m in contributions revenue from the NSW Department of Industry. In 2017-18, the Fund received $10m in contributions from the CSIRO. Further details about these contributions have been disclosed in the overview.

Note 3 Interest Revenue

Interest revenue is recognised using the effective interest method as set out in AASB 139 *Financial Instruments: Recognition and Measurement.*

Note 4 Cash

Cash at bank	**11,302,841**	25,578,861
Term deposits	**56,878,395**	50,225,675
Total	**68,181,236**	75,804,536

Cash and cash equivalents includes 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.

Note 5 Cash Flow Reconciliation

Reconciliation of operating surplus to net cash from/(used by) operating activities:

Operating surplus/(deficit)	**(7,302,776)**	8,402,635
Changes in assets and liabilities	-	-
(Increase)/decrease in receivables	**(295,623)**	297,743
Increase/(decrease) in payables	**(24,901)**	(31,162)
Net cash from/(used by) operating activities	**(7,623,300)**	8,669,216

SCIENCE AND INDUSTRY ENDOWMENT FUND

NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2018

Note 6 Schedule of Commitments

The below table shows the monies SIEF is committed to pay on its executed grant funding agreements as at 30 June 2018, subject to grantees meeting funding milestones.

	2018	2017
	$	$
BY TYPE		
Grants commitments payable	**14,111,011**	16,531,775
GST receivable on grants payable	**(1,282,819)**	(1,500,707)
Total net commitments by type	**12,828,192**	15,031,068
BY MATURITY		
Grant commitments payable		
One year or less	**10,191,852**	14,223,434
From one to five years	**3,259,159**	2,308,341
More than five years	**660,000**	-
Total grants payable	**14,111,011**	16,531,775
GST commitments receivable		
One year or less	**(926,532)**	(1,290,858)
From one to five years	**(296,287)**	(209,849)
More than five years	**(60,000)**	-
Total commitments receivable	**(1,282,819)**	(1,500,707)
Net commitments by maturity	**12,828,192**	15,031,068

Note 7 Contingent Assets and Liabilities

No contingent assets or liabilities existed as at 30 June 2018 (2017: nil).

Note 8 Financial Instruments

The Fund's financial assets are cash and interest receivable on cash. Financial assets are held at amortised cost. They are assessed for impairment at the end of the financial year. Financial liabilities are classified as other financial liabilities and consists of suppliers and grants payable. Due to the nature of SIEFs operations and its large cash holdings it is not exposed to credit risk, liquidity risk or market risk.

Interest rate risk
The Fund maintains an operating bank account and short term deposits which are subject to short term interest rates. Funds are maintained in term deposits for short periods. In 2017-18 the average return on cash and short term deposits was 2.52% (2017: 2.90%).

Note 9 Related Party Disclosures

The fund is a wholly controlled subsidiary of CSIRO. The trustee is the Chief Executive Officer 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. Given consideration to relationships with related entities, and transactions entered into during the reporting period by the entity, it has been determined that there are no related party transactions 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.

CSIRO 'Collaboration lounge' at the world's largest space conference, the International Astronautical Congress.

Credit: Andy Steven

Part 7
Indexes

CSIRO locations

At 30 June 2018, CSIRO had 58 locations across Australia and overseas.

Australian Capital Territory

- Acton
- Black Mountain
- Crace
- Ginninderra
- Tidbinbilla
- Yarralumla

New South Wales

- Armidale
- Australian Technology Park
- Boorowa
- Kensington
- Mopra
- Myall Vale
- Narrabri
- Newcastle
- Parkes
- Sydney
  - Lindfield
  - Lucas Heights
  - Marsfield
  - North Ryde

Northern Territory

- Alice Springs
- Darwin

Queensland

- Atherton
- Bribie Island
- Brisbane
  - Coopers Plains
  - Dutton Park
  - Fortitude Valley
  - Herston
  - Pullenvale
  - St Lucia
- Cairns
- Gatton
- Toowoomba
- Townsville
  - Townsville Australian Tropical Science and Innovation Precinct
  - Woodstock

South Australia

- Adelaide
  - Kintore Avenue
  - South Australian Health and Medical Research Institute
  - Waite Campus

Tasmania

- Hobart
- Sandy Bay

Victoria

- Geelong
  - Australian Animal Health Laboratory
  - Waurn Ponds
- Irymple
- Melbourne
  - Aspendale
  - Clayton
  - Docklands
  - Parkville
- Werribee
  - Sneydes Road
  - South Road
- Wodonga

Western Australia

- Geraldton
- Murchison
- Perth
  - Floreat
  - Indian Ocean Marine Research Centre
  - Kensington
  - Waterford

International

- France
  - Montpellier
- Chile
  - Santiago
- United States
  - Silicon Valley

Acronyms

AAHL	Australian Animal Health Laboratory
AAS	Australian Academy of Science
ADJR Act	*Administrative Decisions (Judicial Review) Act 1977*
AEC	Animal ethics committee
ALA	Atlas of Living Australia
ANACC	Australian National Algae Culture Collection
ANAO	Australian National Audit Office
ANASS	Australian National Algae Supply Service
ANFC	Australian National Fish Collection
ANH	Australian National Herbarium
ANIC	Australian National Insect Collection
ANWC	Australian National Wildlife Collection
APS	Australian Public Service
ASKAP	Australian Square Kilometre Array Pathfinder
ASSETS	Aboriginal Summer School for Excellence in Technology and Science
ATNF	Australia Telescope National Facility
ATSC	Australian Tree Seed Centre
CDSCC	Canberra Deep Space Communication Complex
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent
CPRs	Commonwealth procurement rules
CRC	Cooperative Research Centre
CREST	Creativity in Science and Technology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DARPA	US Defence Advanced Research Projects Agency
DAWR	Department of Agriculture and Water Resources
DICE	Direct Injection Carbon Engine
DoEE	Department of Environment and Energy
DST	Defence Science and Technology Group
EDGES	Experiment to Detect the Global Epoch of Reionization Signature
EDP	SIEF Experimental Development Program
ESD	Ecologically sustainable development
ET	CSIRO Executive Team
EU	European Union
FOI Act	*Freedom of Information Act 1982*
FMD	Foot-and-mouth disease
FSP	Future Science Platform
FTE	Full-time equivalent
HSE	Health, Safety and Environment
ICT	Information and communication technology
IAHER	International Animal Health Emergency Reserve
IP	Intellectual property
ISO	International Organization for Standardization
KPIs	Key performance indicators
LBA	Long Baseline Array
MNF	Marine National Facility
MRO	Murchison Radio-astronomy Observatory
MTC	Major Transactions Committee
MWA	Murchison Widefield Array
NAIDOC	National Aboriginal and Islanders Day Observance Committee
NASA	US National Aeronautics and Space Administration
NCRIS	National Collaborative Research Infrastructure Strategy

NPS	Net promoter score
NRCA	National Research Collections Australia
OIE	World Organisation for Animal Health
PBS	Portfolio Budget Statements
PCT	Patent cooperation treaty
PGPA Act	*Public Governance, Performance and Accountability Act 2013*
PID Act	*Public Interest Disclosure Act 2013*
PV	Photovoltaic
R&D	Research and development
RIFR	Recordable injury frequency rate
SAGE	Science in Australia Gender Equity
SICOM	Science, Strategy, Impact and Investment Committee
SIEF	Science and Industry Endowment Fund
SIR Act	*Science and Industry Research Act 1949*
SMEs	Small and medium-sized enterprises
STEM	Science, engineering, technology and mathematics
WHO	World Health Organization
WHS Act	*Work Health and Safety Act 2011*
WLAN	Wireless local area network

Glossary

Argo: an international program that uses profiling floats to observe temperature, salinity, currents and, recently, bio-optical properties in the Earth's oceans. It has been operational since the early 2000s.

Awn morphology: the form and structure of awn, which are bristly or hairy extensions on plants (such as are found on rye).

Books and chapters: includes monographs, complete or individual chapters, usually published by a commercial publisher.

Conference papers: includes published conference papers and edited proceedings.

Demersal fish: fish that live on or near the bottom of seas and lakes. Demersal fish assemblages refers to the variety and abundance of demersal fish in a given waterbody.

DigiVol: a crowdsourcing platform developed by the Australian Museum in collaboration with the Atlas of Living Australia. It is used by many institutions around the world as a way of combining the efforts of many volunteers to digitise their data.

Ecosystem services: the important benefits for human beings that arise from healthily functioning ecosystems, notably production of oxygen, soil genesis and water detoxification.

Epibenthos: the community of organisms living on the sea floor between low tide and 180 metres. An epibenthic sled is an instrument designed to collect organisms from the sea floor.

Functional Areas: the range of work activities undertaken by CSIRO, grouped into broad areas as follows:

- Research Consulting: Staff members who initiate and deliver research services for industry.
- Research Scientist/Research Engineer: Staff members who conducts scientific research.
- Research Management: Staff members who initiate, develop, lead and promote CSIRO's research capability.

- Research Projects: Staff members who perform scientific or associated work, under the broad direction of research scientists/engineers or research managers, usually by assisting with the planning and completion of the more practical aspects of the work.
- Technical Services: Staff members providing support for scientific research in a diverse range of laboratory and field situations across a range of different research projects. This support consists of the application of accepted technical practices and the development of new practices. The work is usually carried out as a member of a centralised service.
- General Management: Staff members who manage corporate resources or corporate policy development, facilitate the strategic development of organisational capability, and/or create opportunities, matching CSIRO's capabilities to client needs.
- Communication and Information: Staff members who provide information, editorial or industry liaison services either within or outside CSIRO.
- Administrative Services: Staff members who provide administrative and management services to support the effective provision of research and development activities.
- General Services: Staff members who provide routine site maintenance activities.
- Specialist: Staff members whose specialist skills are in high market demand.

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.

Inventions: this is the number of inventions where one or more patent/applications are current. Accordingly, an invention might include a granted patent that is near the end of its life (for example, 20 years) or it might include a provisional patent application that has only recently been filed. Further, one invention might relate to a patent application in one country only, or it might relate to over 20 patents/applications in different countries covering the one invention.

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.

Mass spectrometry: an analytical technique that measures the masses of different chemical substances in a sample.

New inventions: this is the number of new inventions where an application (normally an Australian provisional application) is filed for the first time to protect that invention. A major implication of filing the provisional application is that it provides the applicant with an internationally recognised priority date. A small percentage of CSIRO's new inventions are filed as United States provisional applications.

PC laboratory: a physical containment (PC) laboratory is specifically constructed to prevent the contamination of the worker or the environment by harmful organisms. Depending on the level of risk associated with the microbial work, different levels of containment are certified by regulators, the highest containment level being PC4, which involves work with life-threatening diseases, such as involving the Ebola virus.

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.

Pride@CSIRO: a professional network and social community for Lesbian, Gay, Bisexual, Transgender and Intersex (LGBTI+) identifying employees and other LGBTI+ friendly staff.

Pulsar: a rotating neutron star that emits a focused beam of electromagnetic radiation.

PV system: a photovoltaic system, or solar power system, is a power system designed to supply usable solar power by means of photovoltaics. It consists of an arrangement of several components, including solar panels to absorb and convert sunlight into electricity.

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 or Honours/Master's degree. This excludes CSIRO employees, whose study expenses are considered to be training and development.

Supervised students: students are deemed to be supervised if they have a CSIRO staff member appointed officially by the university as the supervisor for their research project. Normally, CSIRO staff are joint supervisors in conjunction with a university academic.

Technical reports: includes individually authored chapters as well as whole reports that are subject to peer review and usually publicly released.

Type specimen: the specimen that was originally used to name a species or subspecies or that was later designated as the basis for that name.

Vector-borne diseases: illnesses caused by any agent that transmits pathogens into another living organism. Most vectors are organisms such as parasites, e.g. ticks, lice, mosquitoes, but can be inanimate, e.g. dust.

Zoonoses: infectious diseases that can be transmitted between animals and humans, e.g. influenza (bird flu, swine flu), Zika fever, Lyme disease, etc.

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Statement of expectations index

Compliance index: statutory reporting requirements

The index below shows compliance with information requirements contained in section 46 of the *Public Governance and Accountability Act 2013* (PGPA Act), *Public Governance, Performance and Accountability Rule 2014* and the *Science and Industry Research Act 1949* (SIR Act).

This annual report complies with parliamentary standards of presentation and printing, and uses plain English and clear design.

REQUIREMENT	SOURCE	PAGE
Public Governance, Performance and Accountability Act 2013		
The accountable authority of the entity must prepare and give an annual report to the entity's responsible Minister, for presentation to the Parliament, on the entity's activities during the period, by 15 October; or the end of any further period granted under subsection 34C(5) of the *Acts Interpretation Act 1901*. The annual report must comply with any requirements prescribed by the PGPA Rule.	Section 46	1-175
Includes a copy of the annual performance statements in the entity's annual report that is tabled in the Parliament. The annual performance statements must: (a) provide information about the entity's performance in achieving its purposes (b) comply with any requirements prescribed by the rules.	Section 39 (1) and (2)	24-83
Includes a copy of the annual financial statements and the Auditor-General's report must be included in the Commonwealth entity's annual report that is tabled in the Parliament. The annual financial statements and the audit report must comply, and must state whether, in the accountable authority's and the Auditor-General's opinion respectively, whether, they: (a) comply with the accounting standards and any other requirements prescribed by the rules (b) present fairly the entity's financial position, financial performance and cash flows. If the financial statements do not comply, the accountable authority of the entity must add the information and explanations required to present fairly those matters. Similarly, for the audit report, the Auditor-General must state the reasons, quantify the financial effect and state the amount if possible.	Section 42(1)(b) and 43(4)	100-141
Public Governance, Performance and Accountability Rule 2016		
The annual report must be approved and signed by the accountable authority and include details of how and when approval was given. It must state that the accountable authority is responsible for preparing and delivering the annual report in accordance with the section 46 of the PGPA Act.	Section 17BB	ii
The annual report complies with the guidelines for presenting documents to the Parliament	Section 17BC	178
The annual report uses plain English and clear design.	Section 17BD	178
The annual report must specify the entity's enabling legislation, including a summary of the entity's objects and functions and the purposes of the entity as included in the entity's corporate plan.	Section 17BE (a)-(b)	24

REQUIREMENT	SOURCE	PAGE
The responsible Minister is specified.	Section 17BE (c)	86
The annual report provides details of: • any direction issued by any Minister under an Act or instrument during the period • any government policy orders that applied to the entity under section 22 of the PGPA Act • particulars of non-compliance with any of the above directions or orders.	Section 17BE (d)-(f)	86-87
The annual report must include the annual performance statements for the entity for the period in accordance with paragraph 39(1)(b) of the Act and section 16F of this rule. If such a statement is included, the annual report must include an outline of the action that has been taken to remedy non-compliance.	Section 17BE (g)	24-83
The annual report must include a statement of any significant issue reported to the responsible Minister under paragraph19(1)(e) of the Act that relates to non-compliance with the finance law in relation to the entity.	Section 17BE (h)-(i)	86
Information about directors is provided, including names, qualifications, experience, attendance at Board meetings and whether the director is an executive or non-executive member.	Section 17BE (j)	87-89,127
The annual report provides an outline of: • the organisational structure (including subsidiaries) • the location of major activities and facilities and provides a statement on governance practices, including details on – board committees and their responsibilities – education and performance review processes for directors – ethics and risk management policies.	Section 17BE (k)-(m)	20-21 162 86-94
The annual report discloses the decision-making process undertaken by the Board in relation to transactions with other Commonwealth entities or companies, or if the transaction is more than $10,000 (inclusive of GST). • If the annual report includes any of the above information: • if there is only one transaction—the value of the transaction must be included; and • if there is more than one transaction—the number of transactions and the aggregate value of the transactions must be included.	Section 17BE (n)-(o)	92
The annual report details any key activities and changes that affected the operations or structure	Section 17BE (p)	ii, 76, 86-87
The annual report includes particulars of: • judicial reviews and decisions of tribunals that have had or may have a significant effect on its operations • reports about the authority made by the Auditor-General (other than one made under section 43 of the PGPA Act), a Parliamentary committee, the Commonwealth Ombudsman, or the Office of the Australian Information Commissioner.	Section 17BE (q)-(r)	94-95

REQUIREMENT	SOURCE	PAGE
The annual report includes an explanation if information is missing from a subsidiary that is required to be included in the annual report and states the effect of not having the information in the annual report.	Section 17BE (s)	n/a
The annual report includes details of any indemnity that applied during the period given to an officer against a liability, including premiums paid, or agreed to be paid, for insurance against the officer's liability for legal costs.	Section 17BE (t)	93
The annual report provides an index of annual report requirements identifying where relevant information can be found in the annual report.	Section 17BE (u)	167-176
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CSIRO Enquiries provides a single point of contact for industry, teachers and students, the research community and the general public. With a mandate to provide information, guidance and referrals, CSIRO Enquiries responds to more than 30,000 enquiries it receives each year. It also supports our outreach activities as custodians of an extensive stakeholder database and provides outbound e-communication services and online event RSVPs.

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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:

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