



Sustainable
Communities
and Waste

National Environmental Science Program

National Environmental Science Program

Sustainable Communities and Waste Hub
annual progress report 5 May 2021 –
31 December 2021



Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and their continuing connection to land, sea and community.

We pay our respects to them and their cultures and to their Elders past, present and emerging.

Our Indigenous research partnerships are a valued and respected component of National Environmental Science Program (NESP) research.

Letter from the Hub Leader

The Sustainable Communities and Waste (SCaW) Hub is a new program under the National Environmental Science Program (NESP) that offers an exciting opportunity to work with our research users on “solutions science” that will have a positive impact across Australia to help create more sustainable communities and to reduce the impact of waste.

This report provides our first annual update on the progress of the Hub from 5 May 2021 to 31 December 2021.

The SCaW Hub is a consortium comprising five world-class research institutions (or nodes) led by UNSW Sydney, working in partnership with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Monash University (MU), Curtin University (CU), and the University of Tasmania (UTAS).

Our focus is on:



Our vision, to which our 2021 Research Plan was aligned, is to:

- create more sustainable communities and reduce waste impact through innovative, participatory, and circular-based planning, design and supply-chains
- transform waste materials via new science to form the foundation of scalable and local waste to value solutions that are industry, research user focussed
- embrace reconciliation and greater caring for our unique ecosystems by working with our Indigenous peoples to build enduring relationships and sustainable communities
- improve environmental outcomes through better management of waste, pollution and air quality
- increase prosperity and jobs creation by aligning and boosting Australia’s recycling and manufacturing capacity.

We have five Impact Priority (IP) research areas:

- IP1 - Sustainable people-environment interactions (UTAS and MU)
- IP2 - Reduced impact of plastics and other materials (UNSW and CU)
- IP3 - Management of hazardous waste, substances and pollutants (CSIRO and MU)
- IP4 - Improved air quality, forecasting and assessment (CSIRO)
- IP5 - Cross-hub waste impact management initiative (CSIRO and MU).

The research program for the Hub's first year of operation focussed on developing and implementing a codesign framework to guide the development and delivery of the Hub's program of work. This process was kicked off with initial roadshow workshops in each state and territory to introduce the Hub to stakeholders and research users across the country. Research users include those from government, industry and community stakeholders, including Indigenous. Each IP area then worked with their research users to understand and identify their priorities and design project proposals to form the basis of work to be delivered under the Research Plan (RP) 2.

The key outcomes delivered through in our first year under RP1 codesign included:

- identifying and refining research needs and priorities for the Department of Agriculture, Water and the Environment (the Department) and other research users and commencing the development of priority projects that focus on the public good
- a codesigned research program for 2022 (RP2)
- establishing enduring partnerships between the Department, Hub researchers and other research uses
- shared understanding of current research activities and research capability in Australia relevant to the operation of the Hub
- increasing Hub capability for effective codesign
- commencing a process to engage with and understand the priorities of Indigenous researchers and communities.

This codesign process will continue throughout the life of the Hub, working with our research users including Indigenous communities, to design and deliver projects together, as both the Hub and NESP Phase 2 start to mature. Priority projects will focus on reducing the effects of plastics, understanding how to improve air quality, supporting sustainable people-environment interactions and options to minimise impacts of hazardous substances and pollutants, using the Hub's cutting-edge technical capabilities, particularly in the fields of waste and materials processing.

Our first year also focused on developing and negotiating a head agreement between UNSW and the NESP administrator, the Department of Agriculture, Water and Environment and subcontract agreements between UNSW and the Hub's research partner institutions. Governance and operational establishment of the Hub was also undertaken. The agreements provide the legal and financial framework under which the Hub will operate to ensure delivery of activities in a timely manner. Delays, relating to contractual negotiation resulted in the agreements being signed well into the first year. The head agreement was signed on 5 May 2021, and the subcontracts with research institutions between October and November. This caused some challenges in being able to commence work at the pace required and to establish the governance and operations of the Hub. Once these contracts were signed however, codesign activities were progressed quickly and governance and operational aspects enacted.

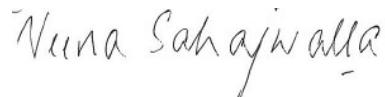
Looking ahead over the next 6-12 months, with the Hub's first round of research projects now submitted for approval to the Department, we will capitalise on the codesign process undertaken during our first year towards commencing implementation of those projects. These projects form the basis for the Hub's Research Plan 2 (RP2).

The Hub's website and social media channels were established subsequent to this reporting period but going forward will provide good opportunity to share the stories and learnings from research project progress, impacts and outcomes.

I would also like to acknowledge and thank Farshid Pahlevani and Mark Sterbic from UNSW for their support and assistance to the Hub Leader and Hub Manager as we worked with our partner research institutions to get the SCaW Hub up and running this year.

I am personally very excited about the next phase of the Hub which will see our first research projects commencing in mid-2022, to help us deliver more sustainable communities and better waste management outcomes.

Yours sincerely



Prof Veena Sahajwalla, Hub Leader

Establishment

The National Environmental Science Program (NESP) is a long-term commitment by the Australian Government. The program funds environmental and climate research. The second phase of NESP builds on the foundations of past work, and funds 4 research hubs from 2020–21 to 2026–2027.

The SCaW Hub, as a new hub under NESP, is in its first year. The initial funding agreement between UNSW and the Department was executed on 5 May 2021. Year 1 activities included establishing a governance and operational structure, subcontracting of Hub consortium research partner institutions, and enabling functioning operational processes, to ensure the effectiveness of the Hub as it moves to establish and implement activities to address research priorities over the years to come.

Due to the annual research plan process, all agreements with the 4 research partner institutions are also on an annual basis with most being agreements executed after this annual reporting period as follows:

Hub partner organisation	Agreement execution date
University of Tasmania	26 November 2021
CSIRO	20 January 2022
MU	1 March 2022
CU	24 March 2022

These contracts set out the obligations and financial commitments associated with the delivery of activities against the Hub's objectives. We are aware the head contracts by the Department for NESP

hub hosts are considerably different to what many institutions are used to through the Australian Research Council, *inter alia*. Nevertheless, the SCaW Hub's sub-contracts with partner research institutions reflect obligations in the Head Contract between the Department and UNSW, as Hub Host, and are broadly consistent with the approach taken by other NESP hubs.

Changes relating to research institutions and Hub engagement

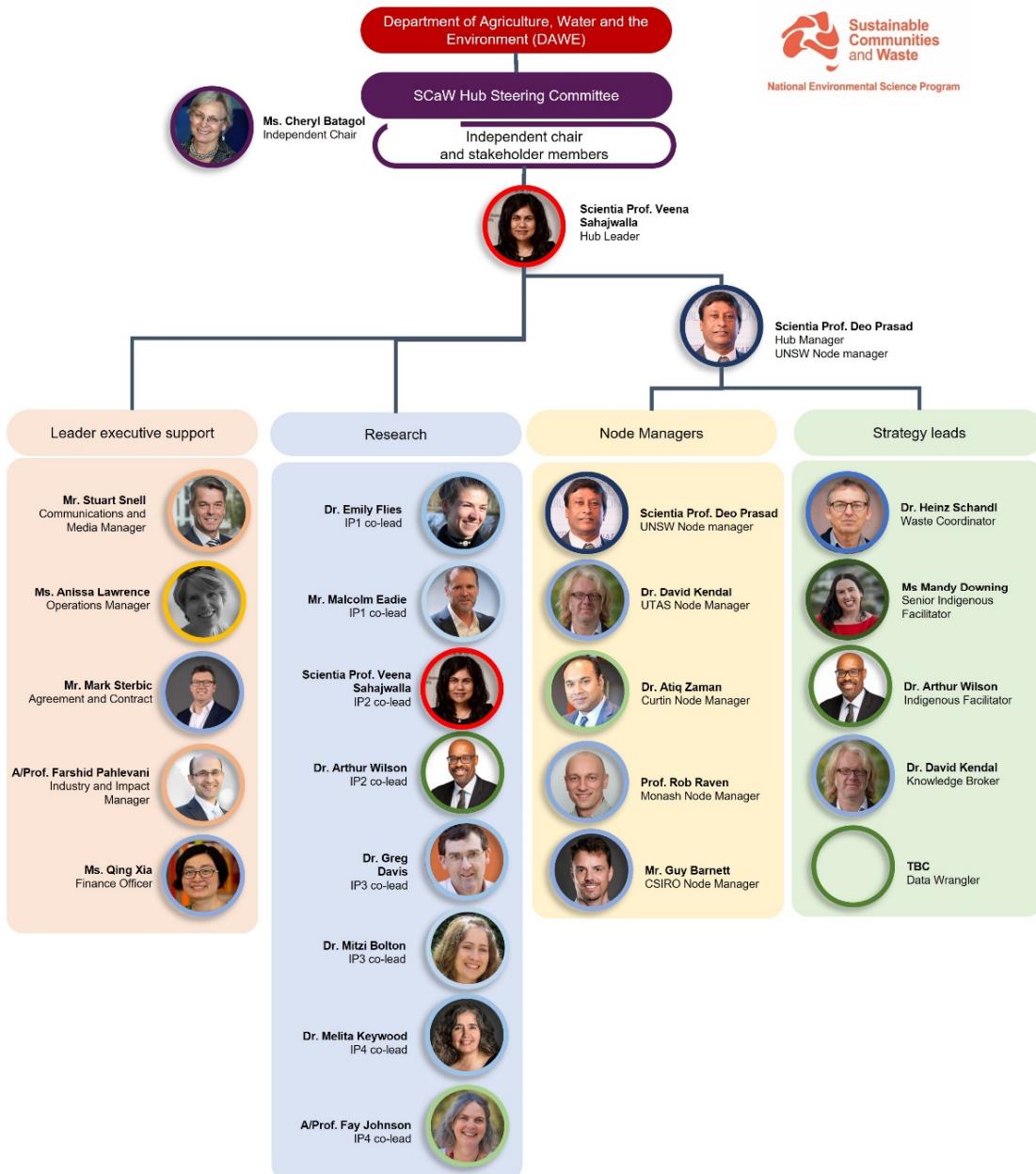
On 23 November 2021, Swinburne University of Technology (SUT), while initially a part of the consortium of research institutions for the Hub, notified UNSW its intention to withdraw from the Hub. In consultation with the Department and the Hub's Steering Committee, SUT's withdrawal was accepted in mid-2021. While there were no contractual matters to sort between SUT and UNSW as Hub Host, there were minor operational adjustments to the IP1 team composition (reduced from 3 co-leads (one of which was SUT) to 2 co-leads) and the Hub's data wrangler prescribed position. Given that no research projects have begun or been approved, the absence of the data wrangler is not expected to become impactful until research projects commence.

In late 2021, CU advised UNSW that Prof Marion Kickett would no longer be involved with the Hub and therefore would no longer be the Hub's Senior Indigenous facilitator, a prescribed position. On an interim basis, Dr Arthur Wilson took up the position, with the support of Curtin's experienced Indigenous leader Stephen van Leeuwen. Dr Wilson also took on Professor Kickett's role as IP2 co-lead. Subsequent to the reporting period, on 1 February 2022, CU's nomination of Mandy Downing as the new Senior Indigenous Facilitator was accepted. Also, after this reporting period, on 1 February 2022, CU advised the Hub that it had changed Node leader to Dr Atiq Zaman.

Key roles and functions

In our first year the following key roles and functions were established for the Hub (refer Figure 1).

Figure 1: SCaW Hub Operational and Governance Structure



UNSW is the **Hub Host** and has contractual responsibility to the Department. Scientia Prof Veena Sahajwalla is the **Hub Leader** for overall leadership with support from several leading researchers from UNSW and within the partner research institutions.

The Hub Host has responsibility for all reporting, finances, overall co-ordination of activities, impact creation and effective communications under the direction of the **Hub Manager**, Scientia Prof. Deo Prasad. The Hub Manager oversees the coordination between Node Leaders, Impact Priority Leads and external stakeholders. The Hub Manager also supports the Hub's Steering Committee and will coordinate the communication of operational information across nodes and other stakeholders as needed.

The Hub has the support of the **Hub's Steering Committee (SC)** to provide oversight for the Hub and is responsible for the review and endorsement of research plans and other documents for the Department's approval. The SC is led by **independent Chair** Cheryl Batagol who has long standing expertise in applicable fields as well as in senior governance roles. The SC comprises nominees from

the Department, as well as the Hub Leader, the Waste Impact Management Initiative Lead, the Hub Manager, the Indigenous Facilitator, and various other stakeholder representative members will be added as agreed by the Department. For the reporting period, they met three time as follows:

25 March 2021, 23 August 2021 and 30 November 2021.

The **Waste Impact Management Initiative Lead**, a prescribed position, (led by CSIRO) coordinates cross-Hub initiatives and research activities that include two or more NESPs and Initiatives and ensures that SCaW impact priorities are linked with the appropriate impact priorities of other Hubs and Initiatives. This includes supporting the research integration within the SCaW Hub and leading the implementation of the waste impact management research (i.e., IP5 of the SCaW Hub).

The Hub's **Senior Indigenous Facilitator**, a prescribed position, (led by CU) also sits on all senior hub committees, such as the NESPs cross-hub senior governance committee and the Indigenous Facilitation Network, to ensure strong engagement, collaboration and partnerships with Indigenous Australians.

Node Leaders are responsible for creating the circumstances for success across their research institutions, for effective operations within their nodes and collectively across all the nodes, as a leadership group. They support **Impact Priority Leaders** to facilitate industry, community and other stakeholder engagements for projects within their purview.

Impact Priority Leaders oversee and support researchers in terms of considering project expressions of interest (EoI), EoI compilation, project performance and progress reporting. In essence, Impact Priority Leaders lead the science all the way to creating impact. IP Leaders prioritise proposed projects for the consideration of the Hub's Steering Committee.

The Hub's **Knowledge Broker**, a prescribed position, facilitates timely and strategic engagement with research users and maximises the impact of the program by helping stakeholders to remain engaged and to co-define research questions and translating the science into practice.

The Hub's **Data Wrangler**, a prescribed position, helps capture and integrate research outputs and automate data flow to national information and data platforms, repositories and decision-support tools.

The Hub's **Communications and Media Manager**, a prescribed position, provides specialist support to the Hub for its engagement and communication activities with government, industry and community stakeholders.

The Knowledge Broker and Data Wrangler necessarily and regularly liaise with the **Industry and Impact Manager** and the **Communications and Media Manager** to ensure information is targeted to the correct audiences, develop clear impact pathways and coordinate how research outcomes are communicated to research users across government, industry and communities. Together with the **Hub Leader**, the **Industry and Impact Manager** and the **Communications and Media Manager** also ensures regular coordinated engagement with departmental program managers and other externally focused stakeholders, as necessary.

Individual specialist researchers in the four cross cutting initiative areas of NESPs support the Hub Leader in determining thematic expertise needs and how best to deliver research impact.

Decision making and Hub operations

Under the head agreement between UNSW and the Department, functional strategies are required and have been developed for:

- data management
- knowledge brokering
- Indigenous partnerships

- communications.

These strategies are supported with operational procedures and processes developed as necessary for ensuring the smooth and effective operation of the Hub. Topics include for how to deal with conflicts of interest and the research codesign process.

The key steps in project development and delivering on priorities for the Hub include:

- Codesign principles and research plans are developed.
- Priorities and research needs are identified and aligned between the Department and partner/research users and potential project(s) designed.
- Ongoing Department and research user engagement takes place feedback is provided.
- Impact Priority leads, with the support of Node Leaders, oversee and facilitate identification of external stakeholders suitable for projects and enable discussions between researchers and other proposed partners/stakeholders.
- Impact Priority leads discuss the project/s with the Hub's Indigenous facilitator(s), Data Wrangler and Knowledge Broker to identify their needs.
- All proposed projects are submitted to the Hub leader, with the Steering Committee endorsement to determine final selections and budgets for the Department's consideration and approval.
- Steering Committee oversees the formation of annual research plans for submission to the Department.
- The Department approves research projects and funding in accordance with submitted budgets for the projects and the milestones payments.

Stakeholder engagement, and project operation and reporting

- After selection of the projects and endorsement by the Steering Committee, acceptance by the Department, and subsequent receipt of milestone payments from the Department, all research institutions (nodes) will receive milestone payments.
- Node Leaders are responsible for ensuring the delivery of projects involving their node.
- Impact Priority Leads lead the science all the way to creating the impact.
- Cross-cutting impact management initiative leaders facilitate the engagement between hubs and manage projects in collaboration with other hubs.
- Indigenous aspects, knowledge, data and communication considerations are incorporated into projects.
- An agreed project reporting format enables the Hub Manager to prepare progress reports.
- Ongoing budget monitoring and reporting is facilitated by Hub Host with input from IPs and Nodes.
- Impact Priority Leads oversee the process and deliverables of each project.

Operations and governance for the Hub will continue to be refined and adapted as the Hub matures.

Research

Progress towards research project delivery and annual outputs

Given the delays experienced in signing subcontracts with research partner institutions, minimal activities beyond codesign had been delivered against milestones included in RP1. It is worth noting that, RP1 has an end date of 30 June 2022 so most reporting against milestones will occur and be reported on, in our 2022 Annual Progress Report.

Attachment A lists the projects funded under the SCaW Hub and provides information on the project status, information on outputs and links to products for all projects (where available). Exceptions to the *NESP data and information guidelines* are also noted there.

All IPs delivered against the interactive Activity Outcomes identified for RP1 – engaging with government, industry and community and Indigenous stakeholders across urban, regional and remote settings to understand national priorities, and inform development of future research plans, and report on findings.

The following table provides a summary of the progress for each IP (research project) against milestones:

Impact Priority	Milestones to 31 December 2021	Due date	Output
IP1	Milestone 1 – Project agreement with Department finalised	31 Aug 2021	Project agreement with UNSW finalised. There was delay in signing this agreement and that affected the progress of project.
	Milestone 2 – Initial codesign workshops delivered (involving the Department and hub partners)	31 Oct 2021	Four codesign workshops involving the Department and Hub research users.
IP2	Milestone 1 – Project agreement with Department finalised	1 Oct 2021	Project agreement with UNSW finalised. There was delay in signing this agreement and that affected the progress of project.
	Milestone 2 – Research project 2 inception meetings/discussions	30 Oct 2021	Five workshops were held in Aug and Sep 2021 to codesign research goals for the different theme of IP2. The workshops were delivered virtually with engagement from federal, state and local government, industry groups, indigenous participants, and researchers. Two panel discussions were held covering topics such as Indigenous participation and the role of technology.
	Milestone 3 – Preliminary Stakeholder engagement plan (concise plan, 6-month timeframe)	15 Nov 2021	Nine in person codesign workshops (3 hybrid, the remainder virtual) and around 30 virtual

Impact Priority	Milestones to 31 December 2021	Due date	Output
			meetings held during this period with the focus on different themes under IP2. One workshop brought together representatives from a selection of NSW government departments looking to connect waste materials, such as waste uniforms, with recycling, reuse, and remanufacturing possibilities through MICROfactories technologies across NSW. The NSW departments include Justice, Treasury, Transport NSW, Family and Community Services, Department of Planning and Environment, Environment, and Procurement.
	Milestone 4 – Delivery of stakeholder list	30 Nov 2021	Hub has created an online list for the list of stakeholders and this list has been added to the master list in the SharePoint. Department has access to this list, and it has been reported regularly to steering committee meetings.
IP3	Milestone 1 – Project agreement with Department finalised. Establishment of project reference group.	1 Oct 2021	Project agreement with UNSW finalised. There was delay in signing this agreement and that affected the progress of project.
	Milestone 2 – Initial codesign workshops held with the Department and hub partners.	31 Oct 2021	Twelve virtual codesign meetings and workshops were held in Oct, Nov and Dec 2021 and additional meetings continued in 2022.
IP4	Milestone 1 – Project agreement with Department finalised	1 Oct 2021	Project agreement with UNSW finalised. There was delay in signing this agreement and that affected the progress of project.
	Milestone 2 – Initial codesign workshops complete	15 Dec 2021	One workshop was completed in 2021, as well as a survey and 5 stakeholder meetings, but the summary report and synthesis understanding of the outcomes was finalised after the reporting period on 28 Feb 2022.
	Milestone 3 – Research needs identified and prioritised	31 Dec 2021	Based on six meetings and co-design sessions with government departments the initial version of these research needs identified and prioritised. But this work has been continuing to 2022 for finalising the research needs.
IP5	Milestone 1 – Signing of contract	15 Jun 2021	Project agreement with UNSW finalised.

Impact Priority	Milestones to 31 December 2021	Due date	Output
			There was delay in signing this agreement and that affected the progress of project.
	Milestone 2 – Contribution to information sessions in all States and Territories	6 Sep 2021	Eight sessions have been conducted and finalised in 2021. A report from these sessions was created after the reporting period in 2022.
	Milestone 3 – Initial codesign workshops with implementation and impact partners and research users complete and summarised in Research Plan 2 (RP2)	15 Oct 2021	This milestone has been pushed back to 2022 because of delay in signing the subcontract with CSIRO and Monash.
	Milestone 4 – High-level initiative strategy (former mission)	15 Dec 2021	This initiative strategy has been developed. It will be finalised in 2022.
	Milestone 5 – Creating the foundational knowledge base from the international literature and best practice	31 Dec 2021	This milestone has been pushed back to 2022 because of delay in starting the project.

The Hub's RP1 focused on codesign activities with no research being undertaken. As a result, no knowledge products or publication type outputs were produced in our first year. A summary of activities for each Impact Priority (IP) area delivered in accordance with RP1 is provided below and key outputs and outcomes by way of priority research themes for RP2 are summarised in the section Measuring Success.

IP1 - Sustainable people-environment interactions (led by UTAS and Monash)

Increasingly, the links between the health of people and the health of ecosystems and the environment are being recognised in research, policy, and programs. Great strides have been taken in national and international research exploring these links between human wellbeing, and environmental and ecosystem health, including through the NESP. However, important research needs remain. The IP1 'Sustainable People-Environment Interactions ('SuPErInteract') is focused on supporting healthy people, places, and interactions.

RP1 sought to codesign a research plan that would ultimately develop practical tools and methods that enable sustainable people-environment interactions to create liveable urban, regional and remote communities by:

- understanding and improving people's connection to nature and people-species interactions in urban, regional and remote communities
- minimising heat impacts and improving water security in urban, regional and Indigenous communities through built form, greening and water sensitive solutions.

IP1 focused on identifying the Department's and partner needs for a nature-based solutions research agenda in Australia, covering greening, heat minimisation, water sensitive design, threatened species recovery and caring for country with Indigenous communities across urban, regional and remote human settlements.

Research needs and priorities were determined through a codesign process which involved three virtual meetings with 42 research users, as well as a codesign workshop that is described in the Hub outcomes and outputs section. The codesign process primarily involved the Department and other research users including state environment departments, the water sector, local government, non-government organisations (NGOs) and Indigenous communities. A synthesis of current research and practice and a stocktake of existing tools/methods was planned. This project sought to deliver on commitments such as in *Australia's Strategy for Nature 2019-2030*, and to scope future research opportunities with the release of new policy such as the *National Climate Resilience and Adaptation Strategy*.

IP2 - Reduced impact of plastics and other materials (led by UNSW and Curtin)

Research in IP2 focuses on reducing the impact of plastics and other waste materials. This research aims to find solutions for waste materials included in the national waste export bans and other problematic materials identified as priorities during codesign in 2021: plastics, textiles, glass, and rubber. IP2 researchers are guided by national priorities *The National Waste Policy 2018* and the *2019 National Waste Policy Action Plan* and supported by further plans including modernisation of recycling and manufacturing capability, and sustainable protection of national materials supply (critical materials).

RP1 sought to codesign pathways to reduce the impact of waste materials, such as plastics, paper, glass, and solar photovoltaic (PV) – that have been affected by the waste export bans under the *Recycling and Waste Reduction Act 2020* – with stakeholders across the full supply chain, including industry, researchers, government, and communities, particularly Indigenous. The aim was to understand the barriers and opportunities to increasing materials circularity in the Australian economy, to reduce waste volumes, and engage with key stakeholders in defining success, connecting supply to strong end markets, and codesigning solutions to waste resource management challenges. Four themes had been identified – recyclables in a mixed form, clean stream recyclables, recycled materials and market ready products. The codesign activities for each of these themes were expected to lay the foundations for future technical and non-technical solutions, which will be codeveloped with our partner research users in subsequent projects under Research Plan 2 (RP2) and beyond.

Five initial workshops with key departmental teams (e.g., Plastics, Packaging and Food Waste Section, Waste Policy and Planning Branch in the Environment Protection Division), were built upon during this reporting period. The activities focused on codesign with over 50 different federal, state and local government representatives, industry and community research users, including some Indigenous community and business stakeholders to achieve these outcomes. Nine workshops (3 hybrid and 6 virtual) and 30 virtual meetings have been held with these stakeholder groups from across the country to identify research priorities and needs and work together on developing projects for delivery under RP2 that address key priorities. The types of workshops that were conducted included a 2-day virtual workshop with a variety of sessions covering Indigenous engagement, technology, and case studies with a select group of Indigenous circular businesses (for example, Native Secrets in NSW) and an Indigenous community (York in Western Australia). This workshop was an example of a successful virtual workshop, due to the ongoing lockdowns in New South Wales and Victoria. Learnings during this reporting period in codesign have informed RP2.

IP3 - Management of hazardous waste, substances and pollutants (led by CSIRO and Monash)

While waste minimisation and recovery of materials are key environmental and economic priorities for Australia, there are clear gaps in our understanding of chemicals of concern contained in our wastes. This includes knowledge gaps about the impacts these chemicals can have on the management, recyclability, and safe reuse of waste-derived materials, and technological approaches to safe handling and treatment of hazardous waste streams.

To achieve Australia's resource recovery targets, including those for hazardous waste, the waste must be rendered benign and have options for reuse without further impacting the quality of materials or accumulating in the environment. The presence of entrained chemicals in waste materials and potential release to the environment through disposal or reuse, limits resource recovery and the retention of materials in the economy. Without defining and addressing the key waste-hazardous pollutant priorities, achieving waste minimisation and resource recovery targets for many waste materials will not be possible by 2030.

To address these challenges, a codesign strategy in IP3 was agreed to determine research focus areas for national hazardous waste priorities for Australia. To implement the codesign strategy, 12 virtual meetings and workshops were undertaken along with literature synthesis. Meetings were held with all state environmental regulatory jurisdictions except the NT EPA (i.e., EPA Victoria, NSW EPA, SA EPA, QLD EPA, EPA Tasmania, Department of Water and Environmental Regulation WA, ACT EPA), and with Defence and 10 petroleum and mining companies. A broad range of waste types were identified across the stakeholders, including organic wastes, electronic (e)-waste, plastics, tyres, remote and mining waste. A range of chemical contaminant priorities were also identified, for example, per and polyfluorinated substances (PFAS), mercury, pharmaceuticals, leachable chemicals from plastics, microplastics, asbestos, and antimicrobials. Stakeholder engagement indicated that there was no consistent waste priority across jurisdictions, but that characterisation and analysis of waste and recovered materials for reuse, including the fate of specific chemicals across waste streams and through waste reuse, was a priority for all jurisdictions and many other partners. In addition, real-world risk assessment enabling safe waste reuse was also a key research priority for all participating stakeholders.

Synthesised codesign learnings were workshopped and reviewed with the Department in November and December 2021, and January 2022. Interim findings were reported to some state jurisdictions. A draft set of research priorities arising from the project was provided to researchers and the Department for feedback in December 2021. Findings were shared with jurisdiction participants, and the national chemical and waste steering groups in December 2021 and January 2022.

IP4 - Air quality, forecasting and assessment (led by UTAS and CSIRO)

While air quality in Australia is generally very good, we continue to see significant health impacts from bushfire smoke, planned burns, traffic, wood-heaters, and local industrial pollution. We understand government departments responsible for air quality, fire and public health urgently need better information for planning and response. Importantly, this information needs to be made available in a timely fashion and in forms that are usable by all, particularly community members at higher risk because of age, occupation, social disadvantage, or existing medical illness.

To reduce air pollution and its impacts we need to engage with governments, agencies, research partners and communities to ensure that rapidly expanding technology platforms that collect, process and share air quality information are deployed for maximum benefit, in ways that both inform government policy and planning, and empower individuals and communities to take actions that reduce air pollution health impacts.

During the first year, researchers in IP4 worked to codesign a series of impactful research projects with stakeholders including the Department and other research users such as state environment departments, local government, community groups, Indigenous groups and other NESP hubs. This engagement included virtual meetings, a survey (completed by 80 participants), an interactive workshop involving 45 participants, and presentations to national bodies including the Healthy Environment and Lives Network, the Australia New Zealand Aerosol Symposium, and the Climate Adaptation cross cutting program of the Climate Systems NES Hub.

IP5 - Waste impact management coordination (led by CSIRO and Monash)

The Hub's waste impact management initiative, like other impact priority areas, had a focus on stocktake and codesign to identify key priorities of research users. The codesign process commenced with workshops in all states and territories to inform the research team about stakeholder research priorities and to build relationships. This process was complemented by 3 workshops with the Department and bilateral meetings with the data and analytics and waste policy sections of the Department as well as meetings with stakeholders to define policy and research problems in priority research areas. The waste impact management initiative also had a focus on cross- and intra-hub coordination and collaboration and on developing the Hub's 'Cross-hub waste impact management strategy' that outlines the coordination of waste-related initiatives not just across the SCaW Hub but with each of the four NESPs.

As an initial step in developing stakeholder relations, 8 multi-stakeholder workshops were held in all states and territories. The workshops were attended by participants from government and industry and included an information session of the key aspects of the Hub and identified the needs of the government and industry participants but also established what kind of contribution each stakeholder was able to make to the overall intent of the SCaW Hub. Some of the relationships that have been built through the early engagement were followed-up with in-depth discussion developing a joint problem definition and scoping of solutions. Some of those relationships resulted in project commitments for year 2 and attracted co-investment from stakeholders. They form the key aspects of the RP2.

For example, extensive engagement with communities in Victoria and Tasmania including 12 stakeholder meetings resulted in the research scope for RP2 investigating community based circular economy governance; engagement in Western Australia resulted in the research scope for assessing the circularity potential for tyres and conveyor belts; and regular meetings (every 6-8 weeks) with the ACE Hub metrics working group resulted in the research scope of Australian circular economy data, metrics and indicators.

Cross-cutting initiatives

Coordination of research activities between NESPs and Initiatives was undertaken by the Initiative leads of the four hubs who met monthly during the reporting period, including with the Department, to design the conceptual arrangements for cross-hub research and facilitate the necessary interactions between researchers from different hubs.

Each hub engaged in close collaboration during the first year of the NESPs program and identified that a cross-hub integration project would be a key deliverable of cross-cutting research. Initiative leads from each hub worked to enable the intellectual contributions and research traditions of the four hubs for collation into an integrated conceptual framework and to enable collaboration across all hub and initiative research domains. A whole of NESPs meeting was held with all hub and initiative leaders in Townsville in 2022 (post this reporting period) to scope several locations for further engagement in RP2. This has been reflected in RP2 planning.

A series of other bilateral cross-hub initiatives were also discussed during RP1 and include:

- contamination pathways and environmental implications of materials leaking into ecosystems (land and water) impacting on human and ecosystem health
- the role of microplastics in water and oceans and resultant ecosystem and food chain implications
- the role of built and living infrastructure in cities and regional areas for mitigating the adverse impacts of climate induced environmental disasters (e.g., infrastructure decisions in cities that mitigate heat, nature-based solutions to mitigate the effects of flooding)

- the waste implications of climate impacts from for example, floods, storm surges and bushfires
- how will a changing climate and emissions reduction measures impact sources of air pollution and secondary pollutant formation
- the effect of hazardous wastes on the health, cultural, social and economic well-being of Indigenous communities.

During 2021, researchers from across the SCaW Hub IP areas engaged with other hubs. For example, IP4 engaged with the climate adaptation cross-cutting program of the Climate Systems Hub to initially scope a subproject to address the question How will a changing climate and emissions reduction measures impact sources of air pollution and secondary pollutant formation? This project will be housed in IP4 for RP2 and will include a scoping study to gather existing knowledge from the international literature and engage with federal and state environmental policymakers to ascertain what potential emission reduction actions are likely to be undertaken by Australia. The project will leverage modelling capabilities of the IP4 team to progress this work as well as modelling capability in the Climate Systems Hub and will contribute to cross-hub activities, with the expectation that effort also be supported by the Climate Systems Hub for this work in future years.

The waste impact management initiative strategy (formerly known as mission strategy) was drafted by Heinz Schandl and Ruth Lane, IP5 co-leads. The strategy was first discussed by the hub's steering committee on 30 Nov 2021 and a revised version endorsed by the committee on 22 Feb 2022. The strategy, a live document is with the department. An update on its status will be included in next year's progress report.

Emerging priorities

In our first year were no emerging priorities identified or presented to the Hub.

Performance against milestones

Performance against funding agreement milestones

All milestones for the reporting period to 31 December 2021 have been met as per the funding agreement (Milestones 1 to 7).

Performance against the research plan milestones

Information on project progress and performance is provided in Attachment A.

Measuring success

Hub outcomes and outputs

The codesign and engagement approach developed in RP1 will be continued to ensure that research outputs are tailored to the needs of research users to enable scientific impact and science-based and practical solutions for the real world and enhance Australia's capacity to build sustainable communities and deliver new waste economy benefits.

Key outcomes and outputs to 31 December 2021 from the SCaW Hub were centred around identifying the key research themes to inform development of RP2 and included:

IP1 - Sustainable people-environment interactions (led by UTAS and MU)

IP1 project work focussed on codesigning a research plan that will lead to research projects that produce outputs and outcomes in future years. To this end, we engaged broadly across the Department's teams, including Biodiversity Policy, Protected Species and Communities Branch, Migratory Species, United Nations Organisations and International Environment, Science and Strategy Team, Booderee and Business Services Branch, Parks Australia, Biodiversity Conservation Section, and Financing Solutions for Nature. We hosted an online, codesign workshop with 43 individuals across 30 different organisations, including the Department and other research users. Through the workshop, we identified a diversity of existing nature-based solutions (NbS) and nature-connection programs and policies across diverse social-ecological systems.

We uncovered some common challenges including resourcing, engaging with, and understanding the distinct needs and experiences of nature across diverse local communities and Indigenous communities. We also identified key research needs of the stakeholders including understanding the diverse values and experience of nature across individuals and communities; tools to support better programming, decision-making, policy and community engagement, particularly in the face of environmental change and diverse populations; how to adapt global NbS frameworks to the Australian context; and critically, how NbS can be scaled up to achieve desired benefits. Following this workshop, we created a report to record and share the workshop outcomes; this report will be publicly available once it has received approval from the Department. We continued to work with attendees and other partners to prioritise the research needs for integration into RP2, and to establish/leverage existing peer networks to advance the science and practice of NbS across Australia.

A pilot project with a national NGO to investigate nature connection with newly arrived migrants was also undertaken but reporting and knowledge products had not been produced by 31 December 2021. These will be made available in 2022.

IP2 - Reduced impact of plastics and other materials (led by UNSW and CU)

RP1 guided researchers participating in IP2 to codesign ways of reducing the impact of plastics and other materials. Researchers engaged broadly across many facets of society including, various groups within the Department, state government agencies, many local councils and council associations, industry groups, individual businesses, community groups, social enterprises, and Indigenous groups. Nine stakeholder workshops and 30 meetings were hosted throughout the first year of operation to inform RP2. Notably the Department's collaborations arising from the codesign process include the Plastics, Packaging Section, Parks Australia, the Marine Debris Section and Sea Dumping section. Other notables include Shoalhaven City Council, various agencies of the NSW State Government, and various Indigenous representatives and groups. These collaborations will be built upon through the implementation of RP2 once approved by the Department. IP2 will continue to codesign RP2 through the start of 2022 to create rigorous multi-year project proposals based on research user needs.

In RP1, 3 projects had been developed targeting the four themes as previously mentioned. While many priorities were identified by research users for each theme, through a prioritisation process undertaken with research users, these were restructured and narrowed down to focus on three different research themes for the short to medium term:

- 1) Understanding the impact of materials contributing to microplastics (plastics and tyres) and identifying potential solutions for management and control to reduce impact
- 2) Finding '*fit for purpose*' technological solutions for regional and remote communities
- 3) Understanding the utility of plastic in artificial reef construction.

The low participation of Indigenous researchers in RP1 revealed a mandate for increasing the engagement of Indigenous researchers and stakeholders in waste discussions and research in RP2.

IP3 - Management of hazardous waste, substances and pollutants (led by CSIRO and MU)

The RP1 project for IP3 resulted in the generation of codesign research priorities and themes for continued research and development in RP2 and beyond. Through the codesign process national hazardous waste priorities for Australia were identified and a draft program of research defined to assist with addressing challenges at the coalface of waste management, recycling, resource recovery and safe waste reuse. Three key near to medium term themes were identified as priorities:

- What is in our waste? - understanding the chemicals in current and emerging wastes
- What is the risk? - de-risking the future through safe waste reuse and resource recovery
- How do I find out? - enhancing information flows for improved outcomes and governance.

The research priorities and themes align with research needs identified from jurisdictional, research and industry partners with respect to characterising what is contained in various wastes, what relevant risks are associated with the release and fate of chemicals through management and processing of wastes, and with the view of enabling safe reuse of waste-derived materials. The data and research outcomes generated through RP2 and later will be shared with relevant partners in regulatory, research, industry, and community settings, as required. The work to date has aligned thinking, and to some degree needs, across state and federal jurisdictions and some industry stakeholders.

Beyond these key themes, it was recognised that a long-term ambition should be to establish a national set of principles, approaches, methods, and techniques for reference and use by jurisdictions and industry to assess Australia's ever-expanding hazardous waste streams and material types for their chemical content, hazardous nature and their potential for safe reuse.

IP4 - Air quality, forecasting and assessment (led by UTAS and CSIRO)

The RP1 project for IP4 has resulted in the generation of codesign research priorities and themes for continued research and development in RP2 and beyond. This included a set of research priorities for RP2 (with commentary for long term research and development).

The key priorities identified from codesign activities included:

- 1) How will a changing climate and emissions reduction measures impact sources of air pollution and secondary pollutant formation?
- 2) How can we reduce exposure to wood-heater smoke?
- 3) How can we ensure that sensor networks produce useful information?
- 4) How effective are the interventions currently being rolled out aimed at reducing exposure to poor air quality?

These questions have formed the basis for a series of subprojects proposed by the IP4 team for RP2.

IP5 - Waste impact management initiative (led by CSIRO and MU)

The RP1 project for IP5 resulted in codesigned research priorities and themes for continued research and development in RP2 and beyond. This included capturing priorities identified by the Department through the engagement process with relevant sections of the Department, especially in the data and analytics and waste policy areas, but also considering the needs of other relevant research users. Five priority themes were identified for prioritisation of research for RP2 and beyond, including:

- Improving Australian metrics for materials, waste and resource recovery. This will be summarised in a circularity gap report and dataset informed by engaging with the experts of the metrics

working group of the Australian Circular Economy Hub, identification of the Department's policy and data priorities and development of a conceptual framework and methodological apparatus, based on international experience and best practices. It will also utilise Australian expertise and research infrastructure.

- Exploring opportunities for increasing value from used tyres and conveyor belts in Western Australia. This will be informed by stakeholder engagement with the waste management authority and tyres association in Western Australia and based on literature research of international best practice in enabling a circular economy of tyres through design and reuse.
- Strengthening governing community-based resource recovery and circular economy initiatives. This will be informed by stakeholder engagement in Victoria and Tasmania and international experience on how to empower local communities building social capital and relationships with all levels of government to support local initiatives for circular economy that align economic, employment and environmental benefits.
- Improving Indigenous community opportunity from waste. A scoping study will be undertaken to create opportunity from waste in Indigenous communities in Western Australia utilising existing relationships with Indigenous stakeholders. It will also engage in a process of problem definition and prioritisation of research directions aimed at creating opportunities for Indigenous communities and businesses for circularity.
- Establishing a place based cross-hub integration project. This will be informed by the regular meetings and discussion of the Initiative leads with the Department, aiming to cohere the research foci of the four hubs and initiatives to enable impact driven research in a specific location and the ability to scale learnings to other places. Importantly, the cross-hub project will seek to bring the whole of NESP research capacity to life.

For each of the waste impact management research priorities a review was undertaken of the current state of knowledge based on the scholarly literature, technical and practitioners' experience, grey literature and of stakeholder conversations informing the theoretical and methodological decisions required to implement first-class interdisciplinary environmental and sustainability policy research. All five research activities of IP5 have strong linkages with other SCaW Hub research priorities and touch points with impact priorities across hubs.

Proposed projects for RP2 were based on the national significance of the issue and the need for significant research innovation that can only be provided by the SCaW Hub consortium. Three of the five subprojects of IP5 were scoped by close stakeholder engagement and thorough analysis of the international and Australian knowledge base to ensure a stakeholder need and a significant research and knowledge gap was addressed. The stocktake that was undertaken allowed the development of conceptual frameworks that align economic and policy issues, technology and innovation issues and metrics, data, indicators and accreditation aspects in one analytical framework. Decisions on research methods were based on the conceptual approach chosen and the most innovative methods and tools available. For two of the proposed subprojects, significant codesign and exploration are required and this will be undertaken under RP2.

Short- to medium-term outcomes – quantitative measures

Table A: Quantitative performance measures (short- to medium-term outcomes)

Notes: Reporting period means the calendar year preceding the Annual Progress Report. For the first year, the reporting period is 5 May 2021 to 31 December 2021. Unless specified otherwise, the term 'research user' refers to the Department and/or external stakeholders.

No.	Performance measure	Result for reporting period	Explanation
1	Proportion of projects (active or completed in the reporting period) for which there is a research user actively engaged in the project: a) codesign b) research delivery c) use and research uptake	a) IP1 - 1/1 IP2 - 4/4 IP3 - 1/1 IP4 - 1/1 IP5 - 4/4 b) No research delivered in RP1 c) N/A	IP1 - During this reporting period IP1's focus was on codesign with research users. IP2 - Research users were actively engaged in codesign processes undertaken. RP1 focus was to deliver codesigned projects for RP2. IP3 - RP1 focussed on codesign of RP2 with jurisdictional and other research users. IP4 - RP1 focussed on codesign of RP2 with jurisdictional and other research users. IP5 - RP1 focussed on stocktake and codesign with research users for developing RP2.
2	Research outputs in the reporting period provided to research users on time and as identified in the approved research plans: d) total number e) proportion	d) IP1 - 2 IP2 - 3 IP3 - 3 IP4 - 8 IP5 - 3 e) IP1 - 100% IP2 - 100% IP3 - 100% IP4 - 100% IP5 - 100%	IP1 - During this reporting period IP1's focus was on codesign. Primary outputs were the minutes from workshops and meetings and presentations to research users. IP2 - The primary outputs were multiple workshops and the minutes arising as well as presentations to research users. Multiple updates were provided to the Department and other stakeholder representatives in the lead up to finalisation of RP2. IP3 - Several RP1 project updates on codesign efforts for RP2 were provided to the Department (Nov and Dec 2021, Jan 2022). Interim findings were reported to some state jurisdictions. A draft set of RP2 research priorities was provided to researchers and the Department for feedback (Dec 2021). RP1 findings were shared with jurisdiction participants, and national chemical and waste steering groups (Dec 2021, Jan 2022). IP4 - Outputs include Workshop Report (1), presentations to the national bodies (2), presentations and reports to SC (4) and RP2 Proposal (1). Several RP1 project updates were provided to the

No.	Performance measure	Result for reporting period	Explanation
			<p>Department (Nov and Dec 2021, Jan 2022). Interim findings were reported to the Department Air Quality Branch in December 2021.</p> <p>A draft set of RP2 research priorities was provided to the Department for feedback (Dec 2021). Workshop report will be shared with workshop participants and stakeholders following the CSIRO internal review process.</p> <p>IP5 - Research plans for year 1 and year 2 and the initiative strategy were developed during the reporting period and were shared with stakeholders from the Department, and regional government and industry partners.</p>
3	Proportion of completed research projects that are confirmed to meet the needs of departmental research users as identified at project codesign stage	100% - all IPs	<p>IP1 - This project is continuing beyond the current reporting period.</p> <p>IP2 - Feedback from the Steering Committee and the Department indicated the key priorities identified for RP2 required codesign beyond 31 Dec 2021. No completed research projects as RP1 was a codesign effort leading to finalisation of RP2.</p> <p>IP3 - Feedback from the Steering Committee and the Department indicated that the key research priorities identified for RP2 that aligned with R&D requirements in hazardous waste, substances and pollutants. This was confirmed through review with our primary researcher cohort, and jurisdictional partners that participated in the codesign process.</p> <p>IP4 - Feedback from the Steering Committee and the Department indicated that the key research priorities identified for RP2 that aligned with R&D requirements of the Department's Environment Protection Division.</p> <p>IP5 - Feedback from the Steering Committee and the Department indicated the key priorities identified for RP2 were aligned with R&D requirements for the waste impact management research but required some additional codesign beyond 31 Dec 2021. This was confirmed through review with our primary researcher cohort, and jurisdictional partners that participated in the codesign process.</p>
4	Number of projects that: a) are Indigenous-led	a) None in year 1 - codesign phase b) 1	IP1 - During this reporting period IP1's focus was on codesign. However, we have Tasmanian Aboriginal man Rob Anders as part of our team at UTas and are engaging with Indigenous groups to

No.	Performance measure	Result for reporting period	Explanation
	<ul style="list-style-type: none"> b) meet research and management priorities of Indigenous stakeholders c) are Indigenous-led projects that also meet research and management priorities of Indigenous stakeholders. 	c) None in year 1 - codesign phase	<p>identify their research and management priorities and develop Indigenous-led projects.</p> <p>IP2 - Curtin led involvement with Indigenous representatives of the WA town of York and led the Hub's introduction to Indigenous representative of Envirobank for future collaboration. Codesign discussions were also undertaken with Native Secrets, an Indigenous business in NSW.</p> <p>IP3 - Due to the compressed time frame of RP1, we were unable to engage directly with Indigenous stakeholders. However, we consulted the NESP Indigenous Knowledge Broker during the scoping period for RP1 and met with Indigenous representative of Envirobank.</p> <p>IP4 - Due to the compressed time frame of RP1, we were unable to engage directly with Indigenous stakeholders. However, we consulted the NESP Indigenous Advisory Group and Indigenous Knowledge Broker during the scoping period for RP1 and have met with the Indigenous advisor for the HEAL Network.</p> <p>IP5 - Due to the compressed time frame of RP1, the engagement with Indigenous stakeholders was very limited and only occurred in the context of developing IP5.01.02 for RP2 focussing on the tyre and conveyor belt sector in WA.</p>
5	Number of peer-reviewed, NESP-funded publications during the reporting period	None - codesign phase	
6	Number of NESP research citations in other researchers' publications during the reporting period	None - codesign phase	
7	Percentage of completed NESP products, research publications, datasets and metadata that are discoverable and accessible in accordance with <i>NESP data and information guidelines</i> and the funding agreement	None - codesign phase. Workshop summary reports/ minutes from codesign were only products.	<p>IP1 - There were no completed IP1 products made discoverable during this reporting period. However, a workshop summary report of an initial codesign workshop with the Department was completed.</p> <p>IP2 - There were no completed IP1 products made discoverable during this reporting period. However, workshop summary reports and minutes from initial codesign workshops were completed.</p>

No.	Performance measure	Result for reporting period	Explanation
			<p>IP3 - This final report will be discoverable and accessible in accordance with <i>NESP data and information guidelines</i> when finalised.</p> <p>IP4 - The codesign workshop report is currently undergoing internal CSIRO approval, other outputs can be made available.</p> <p>IP5 - Literature research and conceptual frameworks will be made accessible in the peer-reviewed literature in the context of year 2 research outputs.</p>
8	The number of datasets and management tools that benefitted from hub research and outcomes (including but not limited to web-based decision support systems; environmental management tools for Indigenous communities, waters and land management; plans of management for Indigenous Protected Areas (IPAs), co/jointly managed parks, marine park plans of management, conservation agreements)	None – codesign phase	
9	Number (full-time equivalents) during the reporting period of: a) PhD students b) post-doc and early-career researchers c) mid-career researchers d) Indigenous researchers e) volunteers (total) f) Indigenous volunteers g) Indigenous sub-contractors	IP1 a) 0 b) 0.3 FTE ECR for one month c) 0.175 FTE for 6 months d) 0.05 FTE for 6 months e)-g) None IP2 a) PhD students – 0.5 b) and c) post-doc and early-career researchers / Engineers – 0.5 d)- g) None IP3 a) None b) 1 post doc/ECR (0.1 FTE)	<p>IP1 - ECR employed with NESP funds on IP1. Other people contributed their time in-kind.</p> <p>IP2 - We have engaged 0.5 PhD student and 0.5 post-doc and early-career researcher.</p> <p>IP3 - Due to the compressed time frame of RP1, we were unable to engage PhD, Indigenous participants or volunteers.</p> <p>IP4 - Due to the compressed time frame of RP1, we were unable to engage PhD, Indigenous participants or volunteers.</p> <p>IP5 - Due to the compressed time frame of RP1, we were unable to engage PhD, Indigenous participants, or volunteers.</p>

No.	Performance measure	Result for reporting period	Explanation
		c) 1 MCR (0.2 FTE)- d) - g) none IP4 a) none b) 0.8 c) 0.6 d)- g) none IP5 - All none	
10	Number of knowledge-sharing and communication events and activities held or shared: a) with on-ground managers (general) b) jointly with Indigenous researchers and Traditional Custodians c) that are Indigenous-led	Note the order of reporting here reflects each IP area starting with IP1 a) (virtual, COVID) IP1 - 9 IP2 - 9 IP3 - 12 IP4 - 9 IP5 - 19 b) (virtual, COVID) IP1 - 0 IP2 - 1 IP3 - 0 IP4 - 0 IP5 - 0 c) (virtual, COVID) IP1 - 0 IP2 - 1	IP1 - Shared knowledge with NGOs, industry, local government and federal government during codesign activities, conference and community presentations, workshops and a roadshow. IP2 - Shared knowledge with NGOs, industry, local government and federal government during codesign activities, conference and community presentations, workshops and participated in whole of hub roadshow to states and territories. IP3 - Knowledge sharing through codesign and iterative feedback during the scoping for RP2 IP4 - Knowledge sharing through codesign and iterative feedback during the scoping for RP2. IP5 - Knowledge sharing through codesign and iterative feedback during the scoping for RP2.

No.	Performance measure	Result for reporting period	Explanation
		IP3 - 0 IP4 - 0 IP5 - 0	
11	Proportion of hub staff and researchers who have completed: a) Indigenous cultural capability training b) Indigenous cultural and intellectual property training c) both Indigenous cultural capability training and Indigenous cultural and intellectual property training	a) IP1 - 1 IP2 - 1 IP3 - 1 IP4 - 1 IP5 - 1 b) IP1 - 1 IP2 - 1 IP3 - 1 IP4 - 0 IP5 - 0 c) IP1 - 0 IP2 - 1 IP3 - 1 IP4 - 0 IP5 - 0	IP1 - Emily Flies (IP1 project co-lead) has completed Indigenous Cultural Awareness training through the Tasmanian Aboriginal Centre IP2 - IP2 team attended other online Indigenous events including one provided by NESP around cultural awareness training. IP3 - Naomi Boxall (IP3 project lead) has completed training regarding Indigenous cultural and intellectual property in house at CSIRO. IP4 - Note that CSIRO staff have undertaken Introduction to Aboriginal and Torres Strait Islander Cultural Awareness @ CSIRO. IP5 - Indigenous cultural awareness training was proposed by the Indigenous facilitator but has not yet been provided. CSIRO has an in-house Indigenous cultural awareness training which some of the CSIRO staff members have attended.
12	Proportion of hub projects overall that fall within the categories of the Three-category approach:	IP1 - 1/1 in Category 1 IP2 - 1/1 in Category 1 IP3 - 1/1 in Category 3 IP4 - None	IP1 - IP1 has Tasmanian Aboriginal man Rob Anders as part of our team at UTAS and engaged with Indigenous groups to identify their research and management priorities and develop Indigenous-led projects. IP2 - Held a two-day online event for multiple Indigenous leaders and other Indigenous stakeholders with strong Indigenous focus

No.	Performance measure	Result for reporting period	Explanation
	<ul style="list-style-type: none"> • Category 1 • Category 2 • Category 3 	IP5 - None	<p>around codesign (lead by the Hub's Indigenous facilitators) for IP2 priorities.</p> <p>IP3 - As noted below under Indigenous Partnerships, the scope and duration of RP1 meant that true engagement with Indigenous partners and communities was not feasible. However, the project team identified that the effect of hazardous wastes on the health, cultural, social and economic well-being of Indigenous communities is not well understood and offers a significant research opportunity that requires further consideration in RP2 and beyond, and perhaps as a whole of Hub issue.</p> <p>IP4 - As noted below under Indigenous Partnerships, the scope and duration of RP1 meant that true engagement with Indigenous partners and communities was not possible.</p> <p>IP5 - As noted below under Indigenous Partnerships, the scope and duration of RP1 meant that true engagement with Indigenous partners and communities was not possible.</p>
13	Proportion of hub projects that have been developed in consultation with the hub Indigenous facilitator or the Indigenous Facilitation Network	IP1 - 1 IP2 - 1 IP3 - 1 IP4 - 1 IP5 - 1	<p>IP1 - IP1 has Tasmanian Aboriginal man Rob Anders as part of our team at UTas and engaged with Indigenous groups to identify their research and management priorities and develop Indigenous-led projects.</p> <p>IP2 - IP2 RP1 was developed in consultation with the Hub's two Indigenous Facilitators.</p> <p>IP3 - IP3 RP1 was developed in consultation with Indigenous Facilitator, Dr Marion Kickett.</p> <p>IP4 - As noted below under Indigenous Partnerships, the scope and duration of RP1 meant that true engagement with Indigenous partners and communities was not possible.</p> <p>IP5 - IP5 RP1 was developed in consultation with Indigenous Facilitator, Dr Marion Kickett.</p>
14	Number of guidelines about best-practice that the hub has produced or co-produced in the reporting period, for: a) knowledge brokering (e.g. https://theDepartment.nespthreatenedspecies.edu.au/publications-)	None - codesign phase	

No.	Performance measure	Result for reporting period	Explanation
	<p>and-tools/connecting-research-with-policy-guide-to-writing-for-policy-makers)</p> <p>b) Indigenous partnerships and products (including design of flagship engagement activities e.g. Our Knowledge Our Way; Three Category Approach)</p> <p>c) environment and climate management within the scope of the hub's research (e.g. Guidelines for the translocation of threatened plants in Australia, Third Edition; https://the Department.nespmarine.edu.au/project/project-d2-standard-operating-procedures-survey-design-condition-assessment-and-trend</p>		

Longer-term outcomes – qualitative measures

While this is the first year of the SCaW Hub, several emerging, longer-term impacts from the Hub's research were highlighted in the codesign discussions. These will start to emerge in the delivery of RP2.

IP1 - Sustainable people-environment interactions (led by UTAS and Monash)

During this reporting period IP1's focus was on codesign. As such, the interest in the value of nature and NbS that IP1 has helped generate or enhance among NGOs, local government and federal government is an important indicator of emerging longer-term outcomes. This interest is evidenced by the strong participation of partners from these sectors in our codesign activities during the reporting period. [For details refer to lines 67-71 and 80 in the SCaW Hub Engagements Table]. During the reporting period, IP1 also engaged the interest of communities, researchers, government officials, Indigenous people and politicians in the health and other benefits of improved people-nature interactions through conference and community presentations.

IP2 - Reduced impact of plastics and other materials (led by UNSW and Curtin)

IP2 is uniquely positioned to support the Department in increasing materials circularity in Indigenous, remote, regional and urban Australian communities over the longer term, given the strong engagement in the first year. Year 1 has positioned IP2, drawing upon their industry, government and community partnerships, developed through the codesign process, to increase circularity of target materials as RP2 and future research plans are implemented. This includes different scales of solutions from the micro to larger formats, as well as different degrees of processing from the manual disassembly of parts to the automated preparation of market ready products.

In the long term IP2 will seek to provide a framework and practical solutions to develop and promote sustainable national supply chains, reducing the impacts of waste materials subject to the waste export ban as well as the impact of microplastics on the environment. It will also help inform the Department's policy design and decision making via community codesigned solutions and on-ground success. Building capacity of others embarking on circular economy journeys through sharing the lessons from innovative recycling solutions for plastics, textiles, glass and tyres will be important as Australia transitions to a circular economy mindset. The outputs from the project may also lead to economic opportunities for Australian Indigenous, remote, regional and urban communities to engage in circular economy ventures.

IP3 - Management of hazardous waste, substances and pollutants (led by CSIRO and Monash)

Through partner, stakeholder and the Department's engagement in RP1 three key themes for prioritisation of research for RP2 and beyond, were:

- 1) understanding the chemicals in current and emerging wastes
- 2) de-risking the future through safe waste reuse and resource recovery, and
- 3) enhancing information flows for improved outcomes and governance

RP2 will seek to generate quantitative data and methodological guides that can be used for evidence-based risk management of chemicals of potential concern identified in our wastes and in repurposed materials. RP2 will start to build a knowledge platform for concentrations of chemicals of potential concern in these waste streams, also providing an indication of leachable components from such waste streams, and their behaviour under field or reprocessing conditions. Improved baseline compositional and leachability analytical methods and data will provide a point of focus from which to enhance information sharing and hazardous waste governance for the target and, through continuation of research in RP3 and beyond, other waste streams.

It is anticipated that the continuity across research plans in IP3 will help to deliver a multi-purpose approach and pave the way for the outcomes to inform a consistent national approach to understanding the chemical composition and leachability of other waste streams in future. This will be achieved through the development of research products and with knowledge sharing between key research, regulatory, industry and community partners that will inform policy, programs and or management decisions, improve waste management and resource recovery practices, and enhance our overall understanding of chemicals in our economy and their impact on our environment.

IP4 - Air quality, forecasting and assessment (led by UTAS and CSIRO)

The outcomes of IP4 research will be realised as the program progresses through RP2 and beyond, as the ultimate outcome of IP4 research over the course of the NESP program will be the reduction of exposure of Australian communities to poor air quality. This outcome contributes to Goals 3 and 11 of the United Nations Sustainable Development Goals by reducing mean annual levels of particulate matter in cities and reducing mortality rates attributed to household and ambient air pollution. This research will result in greater participation in air quality research and uptake of research outcomes by Indigenous researchers and stakeholders in RP2 with the production of a roadmap forward to continue the conversation to build relationships between the IP4 team and Indigenous researchers and communities. The research will provide the tools and knowledge that will empower all scales of government to undertake a co-ordinated approach to interventions that will reduce exposure to air pollution and save lives. Outputs in RP2 that will contribute to this outcome are the improved guidance on the use of high efficiency particulate air (HEPA) filters for air quality in public spaces, guidelines on the selection and use of low-cost sensor networks for the management of local air quality problems and a roadmap for interventions to reduce exposure to woodheater smoke. Finally, the research in this project will enable government to plan for the impacts of a warming climate on future air quality and to maximise the co-benefits of reducing emissions and improving air quality.

IP5 - Waste impact management initiative (led by CSIRO and Monash)

Enabling policy and industry to transition to a more circular economy in Australia which designs out waste from the get-go, uses materials many times over and conserves natural resources is a key requirement for sustainable communities and for reducing waste and pollution. This transition to a circular economic model addresses waste impact management at its source and enables an innovative and economically attractive approach to waste reduction. The priority themes identified through codesign for IP5 and the subsequent projects to be developed under RP2 will help to address core research needs of the waste impact management domain of the SCaW Hub to provide information about the scale of the waste problem and of the circular economy opportunity. They will deliver innovation resulting from industry and science collaboration that requires novel science and are of national significance. They will also identify the governance and planning issues that need be addressed for local communities to successfully engage with the circular economy. Added value will be achieved through aligning research of the four Hubs, in a collaborative and interdisciplinary manner, through a cross-Hub integration project.

NESP impact stories

NESP impact stories are provided at Attachment B. These stories showcase the contribution of NESP funded research beyond contributions to academia, including to the environment, the economy, society, culture, public policy and quality of life.

Collaboration and partnerships

NESP encourages a collaborative, multi-disciplinary approach to environmental and climate research. Key to the success of the hub will be the capacity to foster partnerships across hubs and with a wide range of decision-makers across the Australian community, including Indigenous communities, to achieve positive environmental, social and economic outcomes.

Throughout our first year, research users from IP areas have been involved in a codesign process to identify their key research users' needs and priorities. Codesign means researchers and research users working closely together to design research that meets research user needs and builds on existing research and capability. Given the depth and breadth of research users (governments, industries, and communities across urban, regional and remote regions) in the SCaW Hub as outlined in earlier sections, each IP has tailored their approach to how codesign has occurred with their research user groups to suit the situation and context within which the area is working. This decentralised model is in line with the codesign framework developed by the Knowledge Broker (KB) for the Hub to ensure key principles are met and the foundations are in place from which to strengthen ongoing engagement, collaboration and formulation of partnerships with research users to deliver RP2 and beyond.

The focus for this first year has also been on mobilising and commencing implementation of each cross-cutting strategy developed to support IP areas. At the time of writing this report, past the reporting period, the Hub does not have any research projects approved by the Department.

Our approach to codesign

A key focus of the codesign framework was ensuring strong engagement with research users in the project design, to understand their priorities and research needs, and ensure strong ongoing engagement with research users.

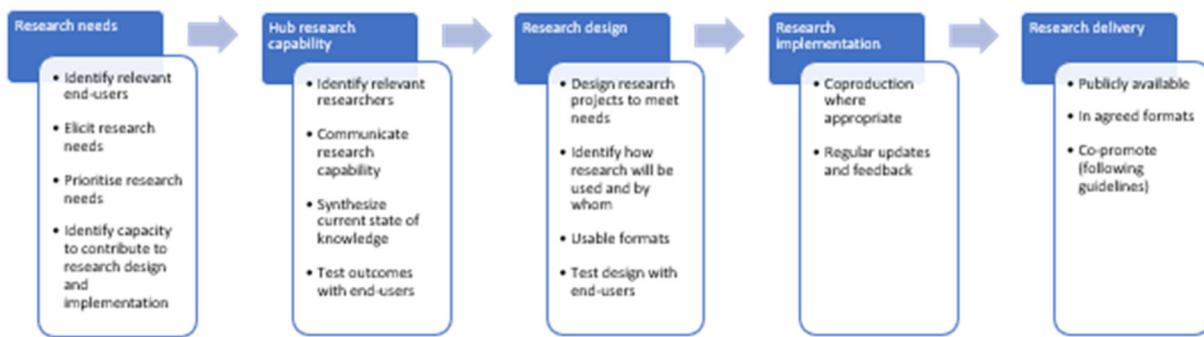
The Hub reported regularly to its Steering Committee on stakeholder engagement activities. The reports, all available in the Hub's SharePoint show a high-level of engagement across a wide range of stakeholders as part of the codesign process.

The Hub's codesign framework is centred around ensuring there are meaningful interactions with research users both at and beyond the design stage to ensure a solutions science focus so that outcomes delivered by Hub are useful, fit for purpose and address the needs of priority stakeholders.

Codesign capability and implementation has varied across the Hub, mostly due to the compressed timeframes, but this process will strengthen as researchers and the Hub starts to operate on more normalised timeframes.

Each IP area has been leading their own codesign process to develop projects for RP2. Once the implementation plan for the KB Strategy is in place, there will be more support, training and guidance where needed to build capability and strengthen codesign processes for RP2 implementation and RP3 development, which in the compressed timeframes provided from the Department, will most likely commence ahead of RP2 being approved.

Codesign is ongoing



The codesign process for the Hub is ongoing over the life of the Hub. A core focus of the codesign is ensuring that opportunity is provided to learn from one another and work towards collective impact. Sharing knowledge and learnings, particularly through the blending of Indigenous knowledge with western science will be key to developing sustainable solutions that support all communities.

In this way, the Hub will play an important role in helping research users navigate solutions to the challenges they are facing through a collaborative and partnership driven approach and through the provision of technical support and knowledge sharing.

Knowledge brokering

The knowledge brokering function has been active in the start-up phase of our Hub. The Knowledge Broker's, a prescribed position role is to facilitate and translate to create productive exchanges between people across the spectrum of researchers and research users to improve knowledge generation and application. A key responsibility of the knowledge broker function within the Hub is enabling the codesign of research plans.

A knowledge brokering strategy (which is a live document) has been developed, endorsed by the Hub's Steering Committee, and then approved by the Department on 28 September 2021. It was developed by the Knowledge Broker in consultation with the Hub Host. It will be revised by the Knowledge Broker in consultation with the Hub Host and IP teams on an annual or as needs basis as the Hub evolves and matures.

The aims of the SCaW Hub knowledge brokering strategy are to:

- guide knowledge brokering activities in the SCaW Hub
- ensure that knowledge brokering activities are embedded in all Hub activities
- provide clarity on what activities the different knowledge broker actors in the Hub will undertake.

While many of the activities identified in the knowledge brokering strategy have been implemented, a plan to fully implement the strategy is in development. A lead knowledge broker has been appointed (Dave Kendal, 0.3 FTE) and an operational knowledge broker (Anissa Lawrence, approx. 0.1 FTE). Representatives from each Hub node and IP areas, as well as the Hub's Media and Communication Manager and Industry and Impact Manager, have been meeting fortnightly to discuss knowledge brokering activities, and had discussions with the Department's research users on effective codesign and knowledge translation.

The knowledge brokering team has participated in or facilitated numerous codesign workshops with the Department and other research users. The KB team has been engaging with the Department's Science Partnerships Section team (managers of NESP) on a fortnightly basis and also been routinely engaging with other hubs (particularly the Marine and Coastal, and Climate Systems Hubs), the Indigenous Advisory Committee and the Hub executive, and contributed to and provided feedback on

a range of Hub and NESP documents. The KB team is working towards finalising a plan to implement the remaining activities identified in the knowledge brokering strategy for delivery in 2022. These activities include developing a knowledge broker training package and starting to develop best-practice guidelines and reference material for researchers. As research projects within the Hub get underway, the focus will turn to the delivery of knowledge products in usable and effective formats and working with the communications manager to publicise and promote knowledge products.

Communication

The Hub's communication strategy, a live document, was endorsed by the Hub's Steering Committee and then approved by the Department on 28 September 2021. It was developed by the Communications and Media Manager in consultation with the Hub Host. The strategy's focus has been on assisting with the start-up of the Hub, a new consortium and research program area under the NESP.

This communications strategy aims to promote and protect the activities and reputation of the Hub and its partners including the Department, while supporting the overall objectives and vision of the NESP. It will be revised by the Communications and Media Manager, a prescribed position in consultation with the Hub Host and the Department on an annual or as needs basis as the Hub evolves and matures.

The Hub's Communication and Media Manager has worked closely with the Hub Host's leadership team on almost all levels of stakeholder engagement, including with the Department, the Hub's Steering Committee and in particular its Chair, and all research and node leaders across the Hub.

This has included collaborating with the Knowledge Broker and KB team in codesign work, the Hub's Indigenous Facilitators and supporting the role of Data Wrangler while the data wrangler position has been vacant, including finalising the Hub's approved data management strategy. The Communication and Media Manager has also participated in the monthly meetings of the NESP hubs communications practice group, along with all communication managers from other hubs and the communication group from NESP. This group discusses communications matters relating to all hubs such as potential stories and interesting news to publicise. The Communications and Media Manager also participated in the Hub's own knowledge brokering working group. This group and the Communication and Media Manager are collaborating on an internal framework to help translate Hub knowledge into impact, via a new KB plan to support the KB strategy.

The Hub developed a communications plan in conjunction with the approved Communications Strategy outlining a range of activities. These activities have included development and finalisation of collateral and materials made available online in the Hub's SharePoint site, including:

- a comprehensive communications guide for all Hub research and node leaders explaining and supporting the many NESP communications requirements
- a brand style for the Hub that meets the NESP branding guide
- a suite of Hub-branded templates to be used for engagement and impact stories, including:
 - fact sheet template
 - pull-up banner template
 - power point template
 - template for reports, briefing and other publications
 - poster template
 - internal project reporting template for the Steering Committee
- an internal Hub image library

- a welcome and Hub overview video

Social media channels and website development were also undertaken but not completed by 31 December 2021.

All products, including communication products, need to comply with NESP requirements.

Content for external consumption from the Hub necessarily requires research projects to be approved and running. As previously noted, the Hub has no projects approved yet. Projects will provide proprietorial content opportunities for the Hub, and IP leads will be encouraged to speak with their ‘Hub hat on’ at conferences and other forums to provide curated communications opportunities. These aspects will be built into the KB plan that is being developed to help capture and translate Hub knowledge.

Indigenous partnerships

The Hub’s Indigenous partnerships strategy, a live document, was endorsed by the Hub’s Steering Committee and then approved by the Department on 28 September 2021. It was developed by the Senior Indigenous Facilitator, in consultation with the Hub Host. It will be revised by the Senior Indigenous Facilitator in discussion with the Indigenous Facilitation Network, the Hub Host and the Department on an annual or as needs basis as the Hub evolves and matures.

The strategy, to be implemented by the Senior Indigenous Facilitator, working in partnership with Hub researchers, promotes an Indigenous partnership approach for the Hub that seeks to facilitate appropriate participation by Indigenous Australian people, groups, and communities when undertaking research activities. The Senior Indigenous Facilitator role is a part-time position.

The Senior Indigenous Facilitator builds awareness within the Hub of cultural governance protocols such as Indigenous Cultural and Intellectual Property (ICIP) through co-ordinating cultural awareness activities. The Hub has agreed that cultural awareness training will be mandatory for all with the option for Aboriginal and Torres Strait Islander members to opt-in to the training should they choose to participate. The Hub’s projects seek to invest in and enhance Indigenous Australian research capacity, including research capabilities in rural and remote Australia. Fostering increased cultural awareness between members of the Hub, the participating nodes, and in the communities where we will be conducting our research is critical over the term of the Hub.

In addition to aligning with the Indigenous partnership principles, our partnership approach supports the NESP three-category approach for research projects. The three-category approach recognises there may be differences in how the Hub’s research users are engaged and involved in our projects. These differences could be related to matters such as limited capacity, the nature of the research being conducted, or the interest in the outcomes of the project.

Working with Node and Impact Priority Leads, the focus in year 1 of the Senior Indigenous Facilitator helped to build partnerships with Indigenous Australian people, businesses and communities in urban, regional and remote areas across Australia. Each IP area through the co-design process was seeking to incorporate Indigenous Australian research, decision-making, and strategies for meaningful engagement within their research plans as reflected in the Hub’s Indigenous Partnerships Strategy. The Hub’s engagement with Indigenous Australian people, businesses and communities is, however, currently at an early stage. Given the limited activity within the first reporting period, foundational skills in cultural awareness and building trust in community needs to be developed. The Senior Indigenous Facilitator will co-ordinate steps to move forward with these activities and document progress made in the next reporting period.

The Hub has not yet made investment to increase Indigenous Australian research capability. However, initial discussions have occurred as reported under the sections discussing research

progress and performance. For example, Indigenous Australian community engagement with members from the Shire of York during the past year in regional Western Australia (as part of IP2 work). The community embraced the opportunity to engage with the Hub which helped Hub members to develop a better understanding of:

- culturally appropriate ways to interact with an Indigenous Australian community
- how to determine the needs of an Indigenous Australian community
- gaining the views of the York Indigenous community regarding recycling and remanufacturing of plastic, fabric and tyres.

The lead Aboriginal Elder, also the Senior Indigenous Facilitator to the Hub, however, was no longer able to participate in the Hub during the year, which means no further work with York can progress at this stage. However, lessons learned will contribute to our approach and developing partnerships with other Indigenous Australian communities. As noted under the section Establishment, there was a change in Senior Indigenous Facilitators in our first year.

The Hub actively engaged with Indigenous facilitators from the other NESPs hubs via the Senior Indigenous Facilitator through several meetings in the first year. This cross-hub Indigenous engagement enables the identification of potential opportunities. An initial step in building the Hub's cultural awareness is to facilitate appropriate training activities. The Indigenous Advisory Committee has selected '*Your mob training*' as a preferred online cultural awareness training provider. The course presents the fundamentals of Aboriginal and Torres Strait Islander culture to members of the Hub. The training will be mandatory, and discussions have commenced with the Hub's Knowledge Broker concerning managing and tracking Hub participation.

Data management

The Hub's data management strategy a live document, was endorsed by the Hub's Steering Committee and then approved by the Department on 28 September 2021. The strategy's function has been conceptualising several initiatives to help embed good data management practices across the Hub. It will be revised by the Data Wrangler in consultation with the Hub Host and the Department on an annual or as needs basis as the Hub evolves and matures.

This strategy aims to:

- guide data wrangling activities in the Hub, in particular outlining how the Hub will manage data at all stages of research
- ensure that findable, accessible, interoperable, and reusable (FAIR) principles are embedded in all Hub activities, and that Hub activities are consistent with the NESPs data and information guidelines
- provide clarity on the activities that data wrangling actor(s) in the Hub will undertake.

The Data Wrangler, a prescribed position has been unoccupied for a period with the withdrawal of Swinburn University of Technology during the year, which had filled the role. Steps are being taken to appoint a new Data Wrangler to the SCaW Hub.

The Data Wrangler's role includes working with the Hub, researchers, the Department, and other stakeholders to translate data and information into relevant databases and tools and to help integrate research outputs into national information repositories, digital systems, and decision-support tools. This includes ensuring the data is produced and used in accordance with the FAIR principles of being discoverable, accessible, and useable, to optimise the use and reuse of public data.

The Data Wrangler will be responsible for coordinating and conducting data discussions with hub researchers, providing guidance on best practice data management, reviewing project data management plans, and tracking data management milestones.

The Data Wrangler will also work with other Hub staff, including the Knowledge Broker and Communication and Media Manager, researchers, and other stakeholders to maximise the usability of the Hub research and increase the accessibility of data to policymakers. The Data Wrangler role will be a part-time position.

One innovative concept is to create a standardised dashboard of key data metrics that can be used by project teams for their outputs and be shared on the Hub's website in an easy-to-read format for a mainstream consumer audience.

The function will develop a framework for how the Hub and its researchers will achieve FAIR research products. It is recognised that discipline-specific standards of data management will also apply, and researchers will be encouraged to use these standards wherever possible.

Hub-level risk management

All risks identified in the Hub's risk management plan are being actively managed. A risk management framework is in place for the Hub, having been approved by the Steering Committee and the Department as a part of RP1 signoff. Risks are identified, managed and reviewed on a monthly basis by the Hub Host leadership team. Risks can be identified through discussions with Node and Impact Priority Leads or through notification from the Department. Where new risks are identified appropriate mitigation measures are developed and communicated to Node and Impact Priority leaders as required. Updates are also provided to the Hub's Steering Committee and the Department as required.

The following risk has been identified in the Hub's risk management plan since the approval of RP1:

Risk	Likelihood	Consequence	Risk rating	Proposed treatment
Research activities, outputs and associated milestones are delayed due to the impacts of the COVID-19 pandemic.	Likely	High	High	Communication regarding the impact of COVID-19 on the delivery of projects will be clearly communicated with the Hub during project updates, as required. Alternate capability in the event of resource impact to be identified.

While currently restrictions are easing across all states and territories, the impacts of the COVID-19 pandemic on research and engagement activities in the Hub going forward are difficult to anticipate should another wave or variant occur.

Certainly, over the past year, all Hub consortium members have experienced challenges, including not being permitted to undertake face to face meetings, through increased caring responsibilities for children who attended online schooling, and from transitioning university teaching to an online format.

While the Hub pivoted to online workshops quite successfully, it meant that codesign processes have been constrained, particularly in relation to engagement with Indigenous communities.