

Editorial workflows: collaborating and integrating across physical and scientific borders

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This paper is the first part of the Schmidt and Ahmad presentation.

Introduction

Many ‘wicked problems’—such as climate change, water scarcity and food security—can only be solved by combining methods, expertise and data from multiple scientific disciplines, such as ecology, hydrology, economics, geology, climatology and agriculture. CSIRO’s Water for a Healthy Country Flagship (CSIRO 2012a) is responding to these challenges by building multi-disciplinary teams in large, integrated research projects. Key to the success of these projects are reporting teams, which provide quality assurance (with respect to content, format and delivery) of multi-authored, multi-disciplinary scientific reports in high-profile, tight timeframe projects. Reporting team members use their editorial, research and technological skills to develop standards, processes and workflows for complex projects that require robust governance and provenance of data and results. Specialised domain knowledge in biophysical and social science, coupled with editorial and mapping expertise, means that staff are key members of multi-disciplinary research teams.

In order to deliver up to 100 reports authored by up to 200 people in up to 15 organisations in more than a dozen locations, the team has developed processes and workflows using widely accessible software (Microsoft Word, Excel and SharePoint). Using examples drawn from projects such as the Sustainable Yields projects (CSIRO 2012b), the Great Artesian Basin Water Resource Assessment (CSIRO 2012c) and the Flinders and Gilbert Agricultural Resource Assessment (CSIRO 2012d, 2012e), this paper will summarise the challenges in such projects, and provide an overview of the simple processes and work practices we use to meet those challenges and deliver high-quality reports on time. In particular, after describing the CSIRO context, this paper will address the following questions:

- How can technology support collaboration and editing?
- What are the minimum requirements for a robust and efficient editorial process in large, geographically dispersed teams?
- How can editors and authors ensure integration of content and messages across disciplines?



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This paper will conclude by identifying those parts of the process that would benefit from automation and technological improvements, so that editors can focus on the more complex editing and writing tasks.

The CSIRO context

Publications are important for a successful scientific career. Scientific authors have their own individual work practices for co-authoring and collaborating, as well as for producing maps, charts, diagrams and equations. All CSIRO authors need to comply with an organisational ‘visual identity’ in their publications, and also follow an internal review and approval process before sending the publication to a publisher or client. Typically, the client or publisher also has a subsequent process for peer review and approval.

Most CSIRO authors write, edit and produce their publications without editors. The challenges for complex projects, however, are greater than for individual publications, thus reporting teams work closely with the authors in such projects to assure quality in content, format and delivery. A ‘complex project’ typically has one or more of the following characteristics:

- a suite of many reports with many authors and teams, and which target several different audiences (see example in Figure 1)
- content from multiple scientific disciplines (see example in Figure 2)
- large number of reviewers and approvers
- geographically dispersed team members
- contributions from multiple partner organisations, collaborators and sub-contractors
- complex governance arrangements (steering committees and panels of technical reviewers)
- results that are potentially a reputational risk for CSIRO.

The challenge is to work together effectively and efficiently when writing and assembling suites of complex technical reports, especially when the team effort crosses borders of geography and disciplines, as well as those of organisational cultures and work practices.

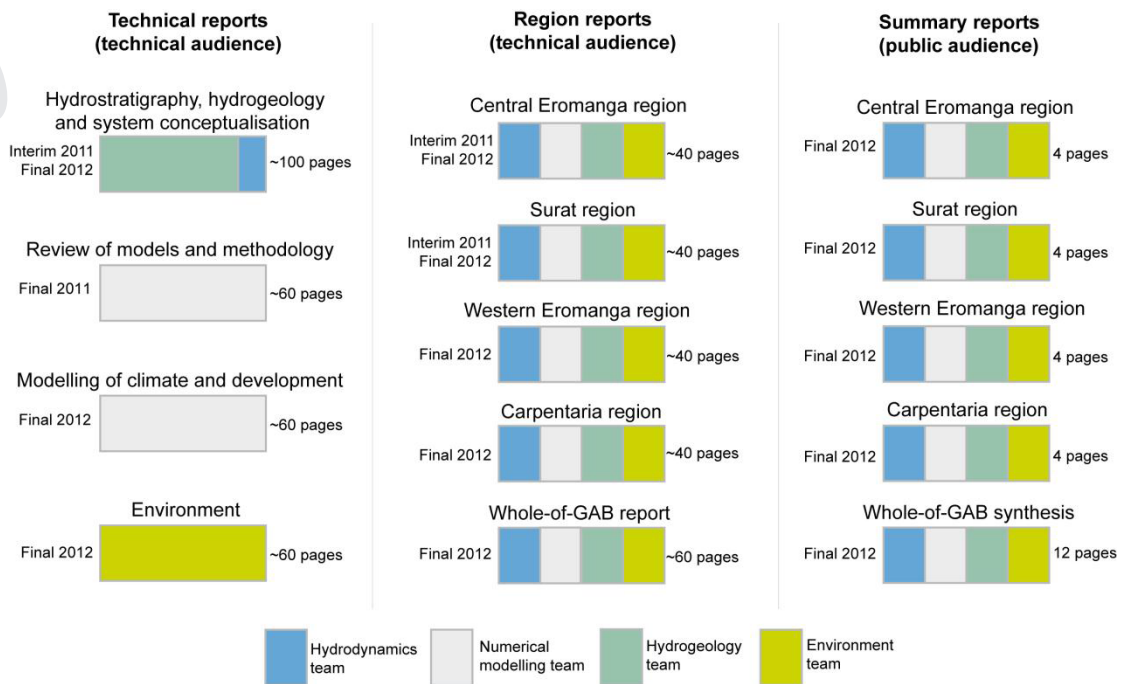


Figure 1 For the Great Artesian Basin Water Resource Assessment (CSIRO 2012c), the outputs are a suite of reports, written by four teams that specialise in four different scientific disciplines. The reports target either a technical or public audience



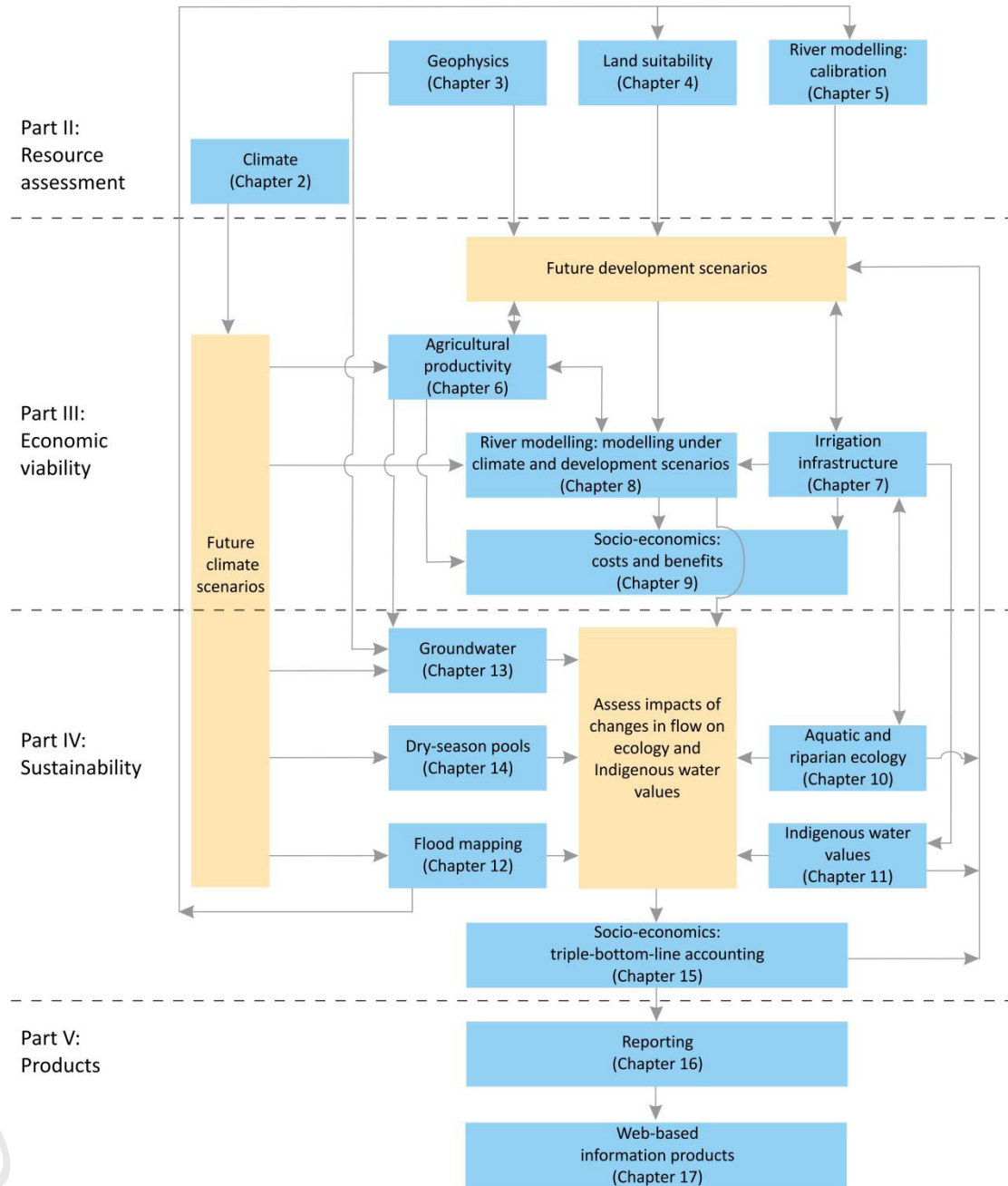


Figure 2 The information flow for the Flinders and Gilbert Agricultural Resource Assessment is reflected in the structure of the report entitled Proposed project methods (CSIRO 2012e). There are five parts to the report ('Part I: Introduction' is not shown), and 12 disciplinary teams wrote individual chapters (indicated by blue boxes). The orange boxes are common concepts that organise and link teams across the entire project

How can technology support collaboration and editing?

We have decided that the most effective and efficient principle is to use easily accessible software that most people have on their computers:

- Microsoft Word and Excel: most authors have access to this software and are generally familiar with using it.
- EndNote (and EndNote Web) are widely used and are effective for teams that share a common bibliography.
- SharePoint, a web-based collaboration tool that includes document management and workflows, is provided free for all CSIRO staff and can also be made available to non-CSIRO authors and collaborators when necessary.



The benefits of using easily accessible software (as opposed to specialty software that must be installed and customised for each new project) are that it:

- is widely available
- can be accessed by both internal and external authors and collaborators
- tends to be purchased, maintained and updated by organisations for their employees
- keeps content on physical storage and processing infrastructure within CSIRO (though non-CSIRO authors may have issues, if their organisations require in-house storage, as does CSIRO)
- does not require extensive additional training.

However, authors vary widely in their Microsoft Word and Excel skills, and often they need additional training. Authors in our projects benefit from the training we provide in cross references and EndNote, but additional training requires resources (time and money) that we do not always have.

SharePoint has a range of features that are useful for collaboration. We use it:

- to manage files, in a centrally controlled, backed-up repository
- to ensure version control (control of the creation and usage of multiple versions of a document, so that two people are not working on the same document at the same time)
- to maintain lists of project contacts, literature, agendas, action items, calendars, timelines, glossary items and decisions on editorial conventions
- to avoid emailing documents (which poses a security risk, and also is problematic when organisations' security software blocks documents with large file sizes or embedded macros).

We have not yet used SharePoint's workflow capability, which allows the automated movement of documents through a sequence of actions or tasks. However, we aim to trial this feature of SharePoint in the future.

Technology can also assist in collaboration via tools for improved communication across physical distances. Commonly in our teams, meetings by phone also involve sharing screens so that documents and images can be viewed by all. Video conferencing or Skyping improves communication relative to a standard phone call. Face-to-face meetings, however, are essential, and thus we travel as often as the budget allows to develop close working relationships with authors at workshops and meetings.

What are the minimum requirements for a robust and efficient editorial process in large, geographically dispersed teams?

A robust and efficient editorial process needs to be:

- **simple** (with minimal overheads and training requirements for authors with a range of abilities)
- **adaptable** (because the pace and results of scientific research are unpredictable)
- **people-centred** (adapted to personalities and skills of project members).

In our large projects, three people are key to developing and implementing an editorial process that balances the timeline, budget and quality of outputs (typically reports):

- The **Project Leader** oversees both scientific and administrative aspects of the project and is responsible for approving the scientific content of the reports.
- The **Reporting Team Leader** oversees the editorial aspects of the project and is responsible for approving the editorial quality of the reports.



- The **Project Coordinator** works with both the Project Leader and Reporting Team Leader in administrative aspects and monitors and adjusts the timeline and budget.

The Reporting Team Leader leads a reporting team, which includes editors, mapmakers and production assistants. The objective of the reporting team is to provide quality assurance for reports. To meet this objective, the team:

- provides templates, standards (Ahmad 2013), processes and workflows for reporting
- advises and assists the Project Leader in integration and consistency, both within the project and with respect to other projects and programs
- edits and produces reports.

The processes that the reporting teams develop and implement have at minimum four components: a sensible timeline, version control, record-keeping for review, and standards.

A sensible timeline ... and someone to monitor and adjust it

Scientists often resist timelines because it is difficult to tell how long it will take to finalise scientific research and write it up. Yet our experience has shown that there is a minimum amount of time required for review and editorial tasks to achieve the expected quality. Under-estimating these times means delays in delivery or Project Leaders and editors with unreasonable workloads at the end.

For a multi-disciplinary report (typically from 100 to 300 pages long with 6 to 12 chapters, all written by different authors), it takes a minimum of 13 weeks (elapsed time) to integrate, edit, review, respond to review, re-edit and produce a publication-quality PDF (Table 1). If this report is part of a suite of reports, then the deadlines of all reports must be staggered, and additional time for ensuring consistency across the entire suite must be included.

Table 1 Typical editorial workflow for a multi-disciplinary report with authors from multiple teams and disciplines

WHO	DOES WHAT?	FOR HOW LONG?
Reporting team	<ul style="list-style-type: none"> • provide templates and standards • assist team in devising outline 	
Authors	<ul style="list-style-type: none"> • write chapters and sections • create maps, plots, tables and other non-text elements 	
Reporting team and Project Leader	<ul style="list-style-type: none"> • Project Leader integrates and writes executive summary and other general material • Reporting team edits 	4 weeks
Reviewers	<ul style="list-style-type: none"> • peer review by (typically) a panel of 5 to 20 experts 	2 weeks
Project Leader, authors and reporting team	<ul style="list-style-type: none"> • respond to review • re-edit • seek final internal CSIRO approval 	4 weeks
External approvers (typically the client or Steering Committee)	<ul style="list-style-type: none"> • assess that the review process was conducted appropriately, but do not review approve 	2 weeks
Authors	<ul style="list-style-type: none"> • final minor revisions 	1 week
Reporting team	<ul style="list-style-type: none"> • final report production 	2 days
TOTAL		13 weeks



Developing, monitoring and adjusting this timeline is a crucial part of the process, and requires a significant amount of time. Reporting team members are involved from the start of a project in developing a realistic timeline, and aim to follow each project with a debrief where we record the lessons learned, including improvements for the timeline. While there are many ways to document and monitor a timeline, the most important thing is not the way that it is done but rather that an appropriate person is keeping track. This person—typically the Project Coordinator—alerts everyone if the team is about ready to run out of money or time: either more resources are needed, or the quality of the reports will suffer.

Version control: to avoid parallel chaos

We aim to minimise the number of work practices that we insist our authors follow, in order to keep our processes simple and to respect individual authors' working styles. One area that we do not negotiate on is a rigidly held practice for version control. Authors who work independently sometimes view this practice as an unnecessary overhead. However, they change their mind after the painful experience of manually merging two versions of a document that has had complex revisions enacted in parallel.

The 'check-out' facility of SharePoint is used for version control. If a document is 'checked in' on SharePoint, then it is available for an author to edit or to revise. The following procedure is followed, using the file 'File-v01.docx' as an example:

1. Check out 'File-v01.docx' on SharePoint. While it is checked out, only the person who has checked it out can work on it.
2. Save as 'File-v02.docx' to a local hard drive.
3. Enter information in the table 'History of this document' in 'File-v02.docx': version, date, person who made changes, to whom it will be distributed, and nature of changes.
4. Revise and edit 'File-v02.docx', tracking changes.
5. Note issues in the table 'Log of issues and comments' in 'File-v02.docx': date, person who logged issue, nature of issue, person who fixed the issue (and notes on how and when they fixed it).
6. Refresh fields (by selecting all of the text in the document and pressing F9) and then save the document 'File-v02.docx'.
7. Upload 'File-v02.docx' to SharePoint.
8. Discard check out of 'File-v01.docx'. (Later, the reporting team will move this document to an archive folder.)

We often have up to 100 versions of a chapter. Thus with time this practice becomes second nature for our authors and editors.

Record-keeping for review

Another area where we insist on a simple practice is in peer review. Peer review is an essential part of scientific publication, and particularly in the projects we work on, this can be a substantial amount of work; 10 to 20 reviewers are not uncommon.

While reviewers often prefer marking up Word documents for their comments, this is not practical for large numbers of reviews. Instead, we provide reports for review as PDF files, and reviewers fill in a Microsoft Excel spreadsheet to provide comments. While there are many more sophisticated ways to gather comments, we find that Excel spreadsheets are understood and used by many people, and thus are a simple yet effective way to collect reviewers' comments. The comments are collated into a master document which includes all comments as well as the project team's responses to review. The CSIRO approver and client use this master document in assessing the review of the reports.



Standards: defining and enforcing

Authors in our projects are required to adhere to editorial standards that we develop and update as the project progresses, in conjunction with the authors (Ahmad 2013). The templates are also designed to provide guidance on formatting and content.

Scientists sometimes struggle to bring their writing up to the standard of editorial quality required for publication. This may partially be due to lack of time, or to lack of understanding of the broader project, or to English not being their first language, or to the lower priority they may place on editorial detail relative to the scientific content. Thus the reporting team can definitely add value. But where does the author’s job end and the reporting team’s job start? It is an uncertain boundary because editorial quality is difficult to measure objectively. We use diagrams such as Figure 3 to communicate our approach.

It is important to define minimum standards to publish and to encourage authors to provide reasonable quality content in their first drafts. If authors meet the editorial standards in their first draft sufficiently, then the reporting team can focus on more complex editing and writing tasks. Few projects in CSIRO have the luxury of editors and the best value for money is when editors can contribute at this more complex level, in optimising the sense, logic and consistency, as well as improving the quality of communication and targeting the audience more accurately.

Thus we spend the first part of a project consulting with the authors in order to define the standards and train them in basic Word, Excel and SharePoint skills. We participate in all scientific meetings, so that we understand the context and can contribute to decisions which impact on the quality of the final reports.

We assess and edit early drafts of chapters, and continue to check and edit as authors revise, so that the final draft has the best chance of being of sufficient quality. Correcting simple errors early ensures that they are not propagated. Also, identifying authors who do not adhere to standards means that additional training can be provided early.

Depending on the resources, we do not spend excessive time and money going from 95 per cent to 100 per cent level of quality at the end, because there are diminishing returns on the effort expended.

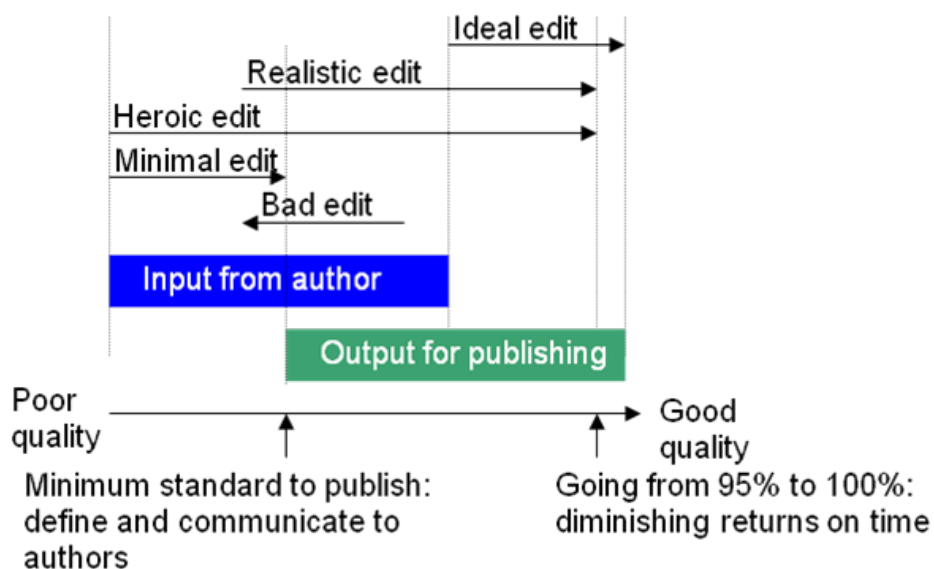


Figure 3 The purpose of editing is to improve the quality of reports. Authors provide content at a range of quality, and the output can be published at a range of quality. Depending on the time, resources and input quality, editors can improve the quality to varying levels. The aim is for a ‘realistic edit’ or an ‘ideal edit’, not a ‘minimal edit’, ‘heroic edit’ or a ‘bad edit’



How can editors and authors ensure integration of content and messages across disciplines?

To ensure that reporting teams can contribute to the integration of content and messages in multi-disciplinary reports, it is best to embed editors and mapmakers within the broader project team early in projects so that they can work directly alongside authors (and especially the lead author). Ideally they work in the same location as authors. Co-location increases ownership, improves relationships, and ensures that the authors realise how much work even a seemingly minor change to a report can entail.

It is important for editors to have sufficient clout and authority within the project team in order to do their jobs well. To this end, we seek editors and writers who are scientists first, so that they understand the content well and thus gain credibility from authors. Reporting teams are involved in all workshops and most meetings where both administrative and scientific decisions are made. We also recognise and ensure that Reporting Team Leaders have the same status as team leaders of scientific teams (for example the hydrology team or ecology team). Thus they contribute to the design and implementation of the reports on an equal footing with the authors—and particularly at the beginning.

Another crucial part of ensuring integration is documenting editorial standards (which we call *Reporting standards* or *Editing conventions*) and training authors to use them. These standards include specifications for maps and plots, as well as punctuation, spelling, acronyms and usage. It is particularly important to specify geographic names (that is, official names for basins, regions or locations) and names of scenarios (plausible storylines used when modelling future conditions).

Glossaries are helpful when integrating multiple disciplines, but can take a lot of time and inspire academic arguments that are less important than finishing the scientific research and writing the report. A balance of effort is important. One efficient strategy is to agree to follow the glossary of a given authority—for example, the National Water Commission's water dictionary (NWC 2012), or the glossaries provided by the Intergovernmental Panel on Climate Change (IPCC 2012).

Other strategies we use to ensure integration include the following:

- Make sure that the structure and table of contents of a report are sensible and that authors have fully thought through the implications. The later the restructure, the more tricky and time-consuming revisions are.
- Check language on maps and plots early.
- Edit generic text before it is reflected to multiple places, and create a conceptual map of where paragraphs are repeated in multiple reports.
- Define the audience early and specifically (for example, a 'well-informed non-expert, such as a water manager who makes policy decisions but does not run hydrological models'). Specify different language requirements for each audience.

Conclusion

This paper summarises how our reporting teams use their technological, research and editorial expertise to deliver high-quality, multi-authored, multi-disciplinary scientific reports in high-profile, tight-timeframe projects using 'cottage industry' technologies and processes.

Demand for our team is growing in CSIRO, and future projects and programs will require more efficiency and capacity, as well as a 'cookie cutter' set of standards and processes that will need to be quickly adopted and adapted by different organisations and teams. Investment is critically required to extend into 'industrial strength' technologies and processes to meet future demands using current best practice.



The three priority activities for future work are to develop, test and implement:

- a robust automated procedure to stitch multiple Word documents into PDFs, thus enabling overnight builds of documents with embedded quality assurance checks
- tools to store and maintain multiple vocabularies (i.e. conventions applicable to CSIRO as a whole, sub-divisions of CSIRO, or specific projects); to combine them automatically into project-specific *Reporting standards*; and to record the rationale for all decisions on language and formatting
- tools to manage non-text elements (maps, plots, tables) in a way that aligns with audit trail requirements (as specified by governance and provenance requirements of projects), and to incorporate these elements into Word documents efficiently.

While we plan to work in the future on enhancing the efficiency of our processes by automating certain aspects, we will continue to ensure that the processes remain simple, adaptable and people-centred. By focussing on these basic principles, we ensure efficient and effective processes.

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Susan Cuddy was instrumental in developing and implementing many of the processes and work practices described in this paper. Maryam Ahmad, Nick Murray and Karin Hosking provided valuable comments on this paper. Cuan Petheram devised the concept illustrated in Figure 2. Simon Gallant made Figure 1 and Figure 2. Finally, I thank both CSIRO Water for a Healthy Country Flagship and CSIRO Land and Water for supporting the reporting teams.

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