Healthy Coorong, Healthy Basin Scientific Trials and Investigations data management framework

Department for Environment and Water
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FrameworkTechnicalReport.pdf

Foreword

The Department for Environment and Water (DEW) is responsible for the management of the State's natural resources, ranging from policy leadership to on-ground delivery in consultation with government, industry and communities.

High-quality science and effective monitoring provides the foundation for the successful management of our environment and natural resources. This is achieved through undertaking appropriate research, investigations, assessments, monitoring and evaluation.

DEW's strong partnerships with educational and research institutions, industries, government agencies, Natural Resources Management Boards and the community ensures that there is continual capacity building across the sector, and that the best skills and expertise are used to inform decision making.

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CHIEF EXECUTIVE
DEPARTMENT FOR ENVIRONMENT AND WATER

Acknowledgements

Respect and reconciliation

Aboriginal people are the First Peoples and Nations of South Australia. The Coorong, connected waters and surrounding lands have sustained unique First Nations cultures since time immemorial.

The *Healthy Coorong, Healthy Basin* program acknowledges the range of First Nations' rights, interests and obligations for the Coorong and connected waterways and the cultural connections that exist between Ngarrindjeri Nation and First Nations of the South East peoples across the region and seeks to support their equitable engagement.

Aboriginal peoples' spiritual, social, cultural and economic practices come from their lands and waters, and they continue to maintain their cultural heritage, economies, languages and laws which are of ongoing importance.

The Department for Environment and Water (DEW) works across the State with Aboriginal South Australians to conserve and sustain Country. Through this work we seek to improve the relationship between Aboriginal and non-Aboriginal Australians and build respect based on mutual understanding and acceptance of each other.

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Summary

The *Healthy Coorong, Healthy Basin* (HCHB) Program is an initiative to restore the ecological health of the Coorong and, through this, support the Coorong, Lakes Alexandrina and Albert Wetland Ramsar site to be a healthy, productive and resilient wetland of international significance. Phase One of the HCHB Program consists of six inter-related projects, including the scientific 'Trials and Investigations' (T&I) Project, which aims to fill critical knowledge gaps and provide the scientific evidence-base to inform management actions to improve the long-term health of the Coorong.

This document describes a data management framework for the HCHB T&I Project. The data management framework will support the planning, collation, storage, sharing and synthesis of outputs from the data and information generated in T&I. The framework is adaptive and will be updated as required to reflect future program needs.

The HCHB T&I data management framework aims to ensure the best practice management and governance of all relevant datasets collected and compiled and used in models and decision-making by researchers, the Department of Environment and Water (DEW) and other collaborating stakeholders. It extends to the outputs generated and shared.

The data management framework draws on relevant South Australian Government standards and key principles for effective data management and sets out a structure with a suite of tools to support data management for the HCHB T&I Project.

An HCHB T&I data management procedure is aligned with the DEW Managing Environmental Knowledge (MEK) policy, procedure, guidelines and templates which provide a comprehensive framework for data, information and knowledge management requirements. Standard MEK Planning processes were applied to the T&I Project to capture high-level data governance, flows and metadata for all T&I components and activities.

The data management procedure summarises the diverse types of data collected and outputs generated through the T&I Project. It also summarises the Coorong models developed and maintained during T&I, including the Coorong Dynamics Model (CDM, a spatially resolved three-dimensional model comprised of several models) and other related models or solutions that could link to the CDM. The data management procedure details quality control/quality assurance standards, governance arrangements, data sharing processes, and metadata standards and requirements.

This HCHB T&I data management framework, by drawing on best practice together with the DEW MEK toolkit, is enabling comprehensive data management for the T&I Project across several institutions. In particular it facilitates governance, traceability, protection, sharing, discovery and reuse of all the project data comprising the scientific evidence base for HCHB modelling and management decision-making.

1   Introduction

The South Australian Government's *Healthy Coorong, Healthy Basin* (HCHB) Program is an initiative to restore the ecological health of the Coorong and, through this, support the Coorong, Lakes Alexandrina and Albert Wetland Ramsar site to be a healthy, productive and resilient wetland of international significance. Phase One of the HCHB Program consists of six inter-related projects, including the scientific 'Trials and Investigations' (T&I) Project, which aims to fill critical knowledge gaps and provide the scientific evidence-base to inform management actions to improve the long-term health of the Coorong. The T&I Project is comprised of six different research components including: Component 1. Nutrient dynamics, 2. Aquatic plants and algae, 3. Food webs, 4. Waterbirds, 5. Ngarrindjeri knowledge and 6. Climate adaptation. A seventh component, *Knowledge translation, application and integration to support site management* (Integration), will unite past and new knowledge gained from trials and investigations and translate it into tools and products to inform and optimise management of the Coorong.

The Goyder Institute for Water Research is the delivery partner for T&I research Components 1, 2, 3, 4 and 6. The Ngarrindjeri Aboriginal Corporation is the delivery partner for T&I Component 5, the Ngarrindjeri knowledge research project. T&I Component 7 Integration is delivered by the Department for Environment and Water (DEW), and includes modelling activities undertaken by a team at The University of Western Australia. This document describes a data management framework for the HCHB T&I Project.[1] The data management framework will support the planning, collation, storage, sharing and synthesis of outputs from the data and information generated in T&I, including the Coorong Dynamics Model (CDM). The framework is adaptive and will be updated as required to reflect future program needs.

Data management is an essential aspect of this large multidisciplinary program. The research conducted by many teams across several institutions will extend understanding and fill gaps in the current knowledge base. The research data will be integrated into the CDM Catalogue in order to assess scenarios and options for decision-making by infrastructure planners, designers, and water managers. It is therefore imperative that the evidence upon which these decisions are based is both fit-for-purpose and transparent to support the level of scrutiny warranted for the scale of the proposal and the long-term. This data management framework seeks to provide the mechanisms for best practice data management including transparency and traceability in the provenance, storage and transfer of data, the methods of evaluation, and decision pathways used to generate the evidentiary science.

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[1] T&I Components 5 and 6 are not included in the data management framework as they are standalone, qualitative components which do not have integrated data flows across other T&I components.

2   Objective

The HCHB T&I data management framework aims to ensure the best practice management and governance of all relevant datasets collected and compiled by researchers, DEW, and other collaborating stakeholders used in models and decision-making, and extends to the outputs generated and shared. This involves clarifying roles and responsibilities around data lifecycle control, data ownership and stewardship, data sharing, record keeping and transparency, quality control and governance.

The objectives of this framework are to:

- Establish data documentation standards and clear guidelines for data management to support the planning, collation, storage, synthesis and sharing of data collected and outputs generated through the T&I Project.

- Ensure that data collected and generated across the T&I Project are captured in corporate systems and available for public dissemination in a suitable format.

- Document the provenance and governance of data and information using DEW 'Managing Environmental Knowledge' (MEK) tools to assist with ongoing data management planning and implementation within the T&I Integration component and more broadly across the HCHB Program.

- Support the development of a data management strategy (under T&I Integration Activity 7.5).

The outcomes of this framework are:

- Best practice data management is adopted and implemented throughout and beyond the life of the T&I Project.

- Data is integrated into the CDM Catalogue and other storage and visualisation solutions as appropriate.

- Previous investment is maximised and duplication is avoided.

- Data collected across the T&I Project is captured in corporate systems, shared across components and the HCHB Program more broadly, and made available for public dissemination in a suitable format.

3   Data management framework

3.1   Principles

The HCHB T&I data management framework draws on relevant South Australian Government standards and key principles for effective data management. These include principles relating specifically to the HCHB Program, and others drawn from best practice and DEW procedures.

HCHB Program priorities for data management include:

- Development of a HCHB T&I data management framework in line with the approved DEW MEK policy, guidelines and toolkit (Department for Environment and Water 2020)

- Traceability of the program's scientific evidence base including appropriate documentation of data and decisions

- Ensuring ongoing, secure and accessible data and storage solutions for the HCHB T&I Project after project closure

- Public access to data contributing to HCHB projects and decisions to maintain transparency and support future requirements.

The framework is also based on:

- The FAIR Data Guiding Principles – that data should be Findable, Accessible, Interoperable, and Reusable. These principles "support knowledge discovery and innovation both by humans and machines, support data and knowledge integration, promote sharing and reuse of data, [and can] be applied across multiple disciplines" (Australian Research Data Commons 2020).

- Best practice elements of successful data management frameworks and plans, including those outlined by the Australian National Data Service (2018) and Michener (2015):

    – appropriately defined roles and responsibilities

    – defined and promulgated standards

    – adequate resources – financial, staffing, and technical infrastructure

    – data security, storage and archiving strategies

    – clear data sharing and publication policies and planning.

3.2   Structure

Data management for the HCHB T&I Project will be supported by the following:

- This high-level HCHB T&I Project data management framework.

- DEW policies and procedures covering Information Management, Open Data and MEK, together with additional policies and/or procedures of partner organisations where relevant. Appendix A provides a summary of the institutional policies and procedures, infrastructure and other support services for each of the relevant T&I project components.

- A Data Management Plan or 'MEK Planning Template' for each T&I component, providing an overview of the component's data/information accountabilities and data inputs and outputs including formats, broad

storage locations, and any potential issues (such as intellectual property and copyright). Appendix B provides an example for T&I Component 1 Nutrient dynamics.

- MEK Charts for each T&I component and each activity within, providing more detail with respect to all data flows, data transformations, storage, and governance. Data and reports that form deliverables are uniquely identified by name and Commonwealth deliverable number and cross-referenced across all project documentation. Appendix C provides an example MEK chart for T&I Component 1 Nutrient dynamics. Appendix D provides the MEK chart for T&I Component 7 Integration illustrating flows of data into the Coorong dynamics modelling environment.

- MEK Catalogues for each T&I component, including a dedicated DEW catalogue, providing broad metadata for all datasets produced. Appendix E provides an example MEK Catalogue for T&I Component 1 Nutrient dynamics.

- An HCHB T&I Component dataset management, transfer and storage process for the duration of the Phase One T&I Project ensuring transparency and governance for the point of truth and versioning of the datasets being exchanged between HCHB T&I research components (i.e. Components 1-4) as a conduit to the model and data repository implemented under Component 7 Integration. Appendix F provides an overview of this dataset management and exchange process between components, the modelling environment and DEW archives.

- An HCHB T&I Data Management Strategy which ensures that all data is managed and stored in corporate databases including cloud based model repository and data storage solutions for storage in perpetuity and ease of dissemination. This strategy has been developed through T&I Integration Activity 7.5 *Integration of research outputs*.

4 Data management procedure

4.1 The Managing Environmental Knowledge (MEK) process

The data management procedure for the HCHB T&I Project is underpinned by the requirement for early and ongoing attention to data governance, including the ability to trace all data inputs to the CDM Catalogue that will inform projects across the HCHB Program.

The DEW MEK policy, procedure, guidelines and templates (Department for Environment and Water 2020) provide a comprehensive framework for the required level of data, information and knowledge management.

The HCHB T&I Integration component will utilise the approved MEK procedure to track processes for data collection, transfer and storage as well as authorised outputs, business owners and usage. The MEK procedure will document the provenance and governance of data and information. Provenance illustrates where the data originated and how the data inputs are transformed into other types of data outputs, and governance describes how evaluation and approvals are applied to the outputs. Other data including reference material (e.g. literature, manuals) will be centrally located for the HCHB Program and will be referenced using the American Psychological Association (APA) standard author–date method of citation or other as required.

In accordance with DEW MEK principles, the T&I Integration component will ensure:

- That data management roles and broad inputs and outputs are documented using the MEK planning template and provided to DEW

- That data management plans (in research institution formats) are provided to DEW and stored within the DEW Data Repository on corporate data network. and also stored within home institutions as part of their organisation-specific data management plans

- That MEK charts describe how outputs from one project are inputs to another, what format and regularity is required, where the data is stored or how it can be accessed and who has authority to endorse data evaluation or publication

- The MEK catalogues for each T&I component will capture the data flows, storage, and ownership of all datasets managed by the T&I Integration component.

4.1.1 HCHB T&I MEK planning

High-level data governance, flows and metadata were captured for all T&I components and activities in 2020 using the standard MEK Planning process.

Preliminary draft MEK charts and catalogues were drawn up from the component project plans and MEK planning templates, which were initially completed by T&I Project component leads. The MEK charts document the components and the activities within them – the key processes; data and information inputs and outputs; and project deliverables. The MEK catalogues document core metadata for each dataset and record the data flows including file names, owners and storage.

A key philosophy guiding the level of documentation in this process is to capture sufficient metadata with the minimum possible additional overhead for the component leads to transparently describe all data associated with T&I activities and components. In essence, the level of detail for component and activity MEK charts is:

- project level data transfers, primarily administered by the Integration component within the T&I Project

- component level charts must capture data flowing to and from components

- activity level charts must contain reference to quality assurance/review processes, and the record of final data transferred (files, version, date, transfer process, storage location).

Workshops to initiate development of MEK charts for each component commenced in mid-2020. In these workshops the pre-drafted MEK charts (based on project plans) provided a valuable structure for developing more detailed and current documentation of data flows and governance. Examples of the HCHB Research Data MEK charts updated to mid-2022 is included in Appendices C, D and F. Note these have had personal and official information redacted for publication.

This documentation will remain dynamic and will be regularly updated (3-6 monthly) until the completion of each HCHB T&I component, at which time the final versions will also detail all data delivered.

4.2   Types of data produced

Data will be collected across the Coorong and also in the Murray Estuary and some regional wetlands and watercourses. Data collected will include measurements of biophysical parameters (continuous in-situ and point field measurements), compilation of historical datasets, laboratory analyses, remote sensing and aerial imagery, spatial, photographs, experimental results, and model outputs. A summary of the types of data collected and outputs generated through the T&I Project is shown in Table 4.1.

Table 4.1.   Summary of the types of data collected and outputs produced under the T&I Project

Output category	Examples
Reports and publications	Synthesis/literature review
	Annual/final reports
	Technical reports
	Guidelines and recommendations
	Scientific publications
Interpretation and communication	State of the Coorong
	Factsheets
	Conceptual diagrams
	Placemats
	Model outputs
	Workshop outputs
Data	Observations, measurements, species identification, isotope analyses, experimental results (continuous in-situ field surveys)
	Coorong Water Quality Sensors monitoring multiple water quality data parameters
	Databases
	Decision data (including outputs from other models)
	Historical data
Spatial/maps	Global Positioning System (GPS) – sampling sites, waterbird movement
	Spatial distribution maps of key Coorong indicators
	Digital Elevation Models (DEM)
	Waterbodies and islands
	Aerial survey/remote sensing imagery
	Bathymetry
	Spatial geodatabases and corporate GIS layers
Photos/videos	Photos for communication purposes
	Sampling records and experiments
Modelling	Model scenario outputs for a range of parameters in various formats (core models summarised in section 4.2.1)

4.2.1   Models developed and maintained

The Coorong Dynamics Model (CDM) is a spatially resolved three-dimensional model to simulate the environmental conditions within the Coorong (Hipsey et al. 2022). It is not a single model, but a system of models (CDM Catalogue) that can be configured, applied and coupled in various ways for different purposes (Hipsey et al. 2022). The core models are summarised in Table 4.2.

Table 4.2.   Summary of models comprising the Coorong Dynamics Model (CDM) Catalogue

Model	Description	Functionality
TUFLOW-FV hydrodynamic model	Finite volume hydrodynamic model, flexible mesh 1. Fine resolution model 2. Coarse resolution (rapid) model	Accounts for variations in water level, salinity, temperature, and density in response to tides, inflows and surface thermodynamics.
SWAN (Simulating WAves Nearshore)	Numerical wave model	Wave parameters in coastal areas, lakes, and estuaries for given wind, bottom, and current conditions.
AED2 (Aquatic EcoDynamics)	Water quality and habitat model	Simulation of water quality, aquatic biogeochemistry, biotic habitat, and aquatic ecosystem dynamics.

The outputs from the core models are used to drive habitat models simulating habitat models for *Ruppia*, fish and algae. The CDM Catalogue extends to the large volume of data used by the various models for either model inputs (boundary conditions) or model assessment (calibration or validation).

Figure 4.1 presents the flow of data sources summarised in Table 4.2 and of model scenario outputs that are utilised by other associated models or data solutions. This relates to the CDM Catalogue (Hipsey et al. 2022), which is implemented and maintained in the model and data Git repository by The University of Western Australia and DEW. Additionally, DEW maintains a BitBucket model repository, which houses the required multiple versions of the fine resolution TUFLOW-FV models.
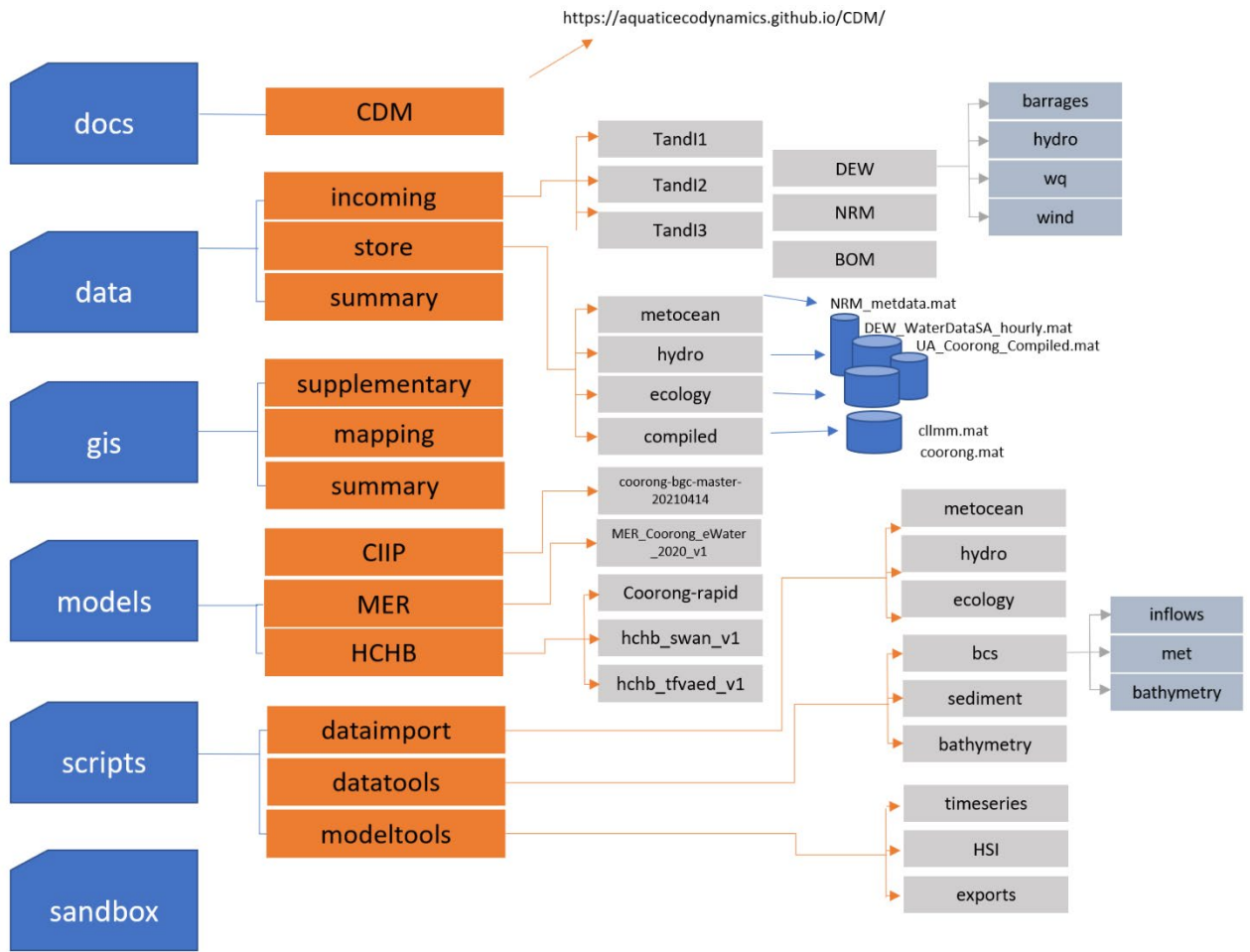
Figure 4.1. Schematic of data sources as they relate to the Coorong Dynamics Model (CDM) Catalogue as embedded in the Git model and data repository (Source: Hipsey et al. 2022).

Other related models or solutions that could link to the CDM Catalogue and those that store and display model outputs are summarised in Table 4.3. These models or solutions either provide inputs to, or utilise outputs from, the CDM Catalogue.

Table 4.3.   Other models and solutions (tool kit) that are, or could be, linked to the Coorong Dynamics Model (CDM) Catalogue

Model	Purpose and link to CDM Catalogue
Food web models	Quantitative food web models developed as part of T&I Component 3 *Restoring a functioning Coorong food web* (). These quantitative food web models for the North Coorong (Murray Estuary and North Lagoon) and South Lagoon have been developed to inform the decision-making about strategies to restore a functioning South Lagoon food web (Goldsworthy et al. 2022). They incorporate new knowledge from the T&I Project and are the first quantitative ecosystem models developed for the Coorong (Goldsworthy et al. 2022).
Waterbird response models	Key waterbird species response models for the Coorong developed as part of T&I Component 4 *Improving habitat for waterbirds*. These quantitative response models for representative waterbird species link the occupancy (i.e. probability of presence) and abundance of these species, and the proportion of birds observed foraging, to abiotic drivers (e.g. water level and salinity) and biotic drivers (e.g. density of fish, chironomid larvae, Ruppia Community) (Prowse et al. 2022).
Solution	**Purpose**
CDM repository	Git repository for model and file storage and version control
Coorong Scenario Datastore and Investigator	Cloud-based storage and visualisation of model scenario outputs (developed as part of the HCHB Water Resource Optimisation Project)
Coorong, Lower Lakes and Murray Mouth (CLLMM) Management Action Database (MAD)	Storage and visualisation of data relating to barrage management action decisions (developed as part of the HCHB Water Resource Optimisation Project)
Water Data SA CLLMM dashboards	Visualisation of Lower Lakes and Coorong data stored in the DEW water database
TUFLOW-FV operational model	TUFLOW-FV fine resolution model recalibrated and optimised for application to operational scenarios under the barrage release window scenario modelling project

4.3   Integration quality control/quality assurance standards

The Department for Environment and Water, the Goyder Institute for Water Research and its partner organisations, and The University of Western Australia each have their own organisation-specific policies, procedures and guidelines related to quality control and quality assurance. These are applied to the HCHB T&I deliverables and outlined in the Quality Management Strategy section of each T&I Component's project plan. The T&I grant agreement with the Goyder Institute for Water Research also specifies requirements related to quality control and review of HCHB T&I outputs.

Quality assurance of datasets should occur within each T&I component before data are released or shared with other component and project teams. This includes consistency of data formats where interim and final data sets are provided and the provision of associated metadata. The MEK charts document governance of data for each T&I component, which should include review and release authorisation requirements.

4.4   Governance

HCHB T&I data management and MEK products will be developed in line with the following governance arrangements:

- Data management coordinator role is within the T&I Project leadership team.

- Project data/information roles and responsibilities have been identified for each component and detailed in the relevant data management documentation (MEK Planning Template and/or Data Management Plan, and MEK charts).

- DEW will implement agreed metadata standards to be used by T&I teams (i.e. outlined in the MEK catalogue).

- DEW and HCHB partner institution policies and procedures for distribution and sharing of data and other products, including appropriate data access control/restrictions during and after the project subject to consideration of:

    – data classification (including the South Australian Information Classification System),

    – Intellectual Property requirements (e.g. Honours or PhD students, grant agreement terms and clauses),

    – personal identification sensitivities,

    – environmental sensitivities (procedures aimed at minimising risks to species and habitats), and/or

    – any other constraints/restrictions arising from program governance, funding, and policy considerations.

4.5   Sharing data

Throughout the life of the HCHB Program data will be exchanged between projects and between T&I Project components and DEW via the Integration Component for a number of uses, for example as an input to, or output from, the delivery of modelling outputs (T&I Activity 7.2) and scenario testing (T&I Activity 7.4). Additionally, synthesised information is required to support community engagement for the HCHB Program. Adopting a consistent, transparent, best practice approach to data management ensures quality assurance, traceability of outputs and the application of best available data in decision making.

A HCHB T&I Component dataset management and transfer process has been developed to ensure transparency and governance for the point of truth and versioning of the datasets that are being exchanged by the HCHB T&I components including the modelling activities in Component 7. The MEK charts for the HCHB T&I Component dataset management and transfer process and for Component 7 Integration are shown in Appendix F and D, respectively. The process is administered principally via the monday.com data sharing portal and documented in a set of MEK catalogues. The data is stored in the corporate data repository and pushed up to the Git model and data repository.

Procedures for sharing T&I Project data and information depend on the level of the sharing:

- Within project teams at activity level or lower, data sharing will be managed by the task and/or activity lead(s), and is not within the scope of this framework.

- Between components, data sharing will be managed by component and task leads, and will be undertaken in line with the dataset management and transfer process. DEW only manages the sharing of data between the Integration component and the T&I research components, and not between other components.

- There will be a secure DEW managed facility within the DEW data repository with shared access across the HCHB Program for T&I Project data.

A HCHB T&I knowledge and data management strategy is being developed through T&I Integration Activity 7.5. The strategy describes the processes and protocols to plan, collect, organise and manage data flows as well as share, protect, store and maintain knowledge. It ensures ongoing stakeholder access to knowledge and data to inform research, tools and models that will support management decision-making to improve the long-term health of the Coorong. The T&I knowledge and data management strategy considers final data and information storage beyond the life of the program, including requirements for public accessibility. In the interim data will be stored in a DEW/Goyder Institute for Water Research corporate facility and on the Git model and data repository that The University of Western Australia and DEW collaboratively maintain, as well as the DEW BitBucket model repository.

4.6   Metadata standards and requirements

Metadata will be maintained for all T&I datasets in line with DEW MEK standards and as outlined in the dataset management and transfer process (Appendix F). Under this documentation, an agreed mandatory metadata file is to be provided with each project dataset that provides rich, contextualised information about the data. Metadata will be maintained by T&I research leads and DEW team members and stored in the agreed DEW HCHB T&I data repository.

5   Conclusion

This HCHB T&I data management framework, by drawing on best practice together with the DEW MEK toolkit, is enabling comprehensive data management for the T&I Project across several institutions with the minimum possible overhead.

In particular it facilitates governance, traceability, protection, sharing, discovery and reuse of all the project data comprising the scientific evidence base for HCHB modelling and management decision-making.

The framework is adaptive and is therefore a living document and process for the duration of the T&I Project, and will be updated as required to reflect future program needs. It supports the ongoing data management and evidence transparency processes for this project, along with the final data storage and metadata recording upon project completion to ensure data and knowledge discoverability for future use.

6   Appendices

Data management topic/capability	Component 1: Nutrient dynamics (C1 MEK Planning Template provided)	Component 2: Aquatic plants and algae (C2 Data Management Plan provided)	Component 3: Food webs (C3 MEK Planning Template provided)	Component 4: Waterbirds (assumptions in advance of MEK process)	Component 7: Integration (data exchange management process)
Institutional policies and procedures	The University of Adelaide (UofA) Research Data and Primary Materials Policy (UofA 2019)	The University of Adelaide (UofA) Research Data and Primary Materials Policy	Flinders University Research Data Management Guidelines (Flinders University 2015)	The University of Adelaide (UofA) Research Data and Primary Materials Policy	DEW Managing Environmental Knowledge (MEK) and Open Data Policies and Procedures; UofA Research Data and Primary Materials Policy
IT infrastructure	UofA Box secure file storage Also Shared program data repository – DEW; Goyder Institute for Water Research/DEW website for tech report / journal publication	Ref C2 DMP. University storage incl UofA Box; LabArchives. Also Shared program data repository – DEW	Ref C3 MPT – file storage provided by SARDI, Flinders Uni, UofA, DEW. Also Shared program data repository – DEW	UofA Box secure file storage. Also Shared program data repository – DEW	DEW and UofA Box secure file storage. GitHub model repository Also Shared program data repository – DEW
Support services	UofA IT support and secure file storage / DEW Data and Information Unit	Ref C2 DMP. UofA IT support and secure file storage	Flinders Uni, SARDI, DEW IT support and secure file storage, DEW Data and Information Unit	UofA IT support and secure file storage	DEW and UofA IT support and secure file storage. DEW Data and Information Unit
Managing metadata	HCHB MEK Catalogue; using agreed standards and controlled vocabulary where possible	HCHB MEK Catalogue; using agreed standards and controlled vocabulary where possible. Also thorough documentation, stored with data	HCHB MEK Catalogue; using agreed standards and controlled vocabulary where possible	HCHB MEK Catalogue; using agreed standards and controlled vocabulary where possible	HCHB MEK Catalogue; using agreed standards and controlled vocabulary where possible. Also thorough documentation, stored with data
Managing research/scientific data	Ref C1 MEK Planning Template. Controlled data access and sharing	Ref C2 DMP. Grant agreement re intellectual property; controlled data access and sharing	Ref C3 MPT. Controlled data access and sharing	Controlled data access and sharing	Controlled data access and sharing

Note: T&I Components 5 and 6 are not included in the data management framework as they are standalone, qualitative components which do not have integrated data flows across other T&I components.

B. Example MEK planning template for T&I Component 1 Nutrient dynamics

Managing Environmental Knowledge (MEK): **Planning Template**

Project:	**HCHB Nutrient Dynamics**
Primary Contact:	------------
Date:	7-Aug-20

Project Data/Information Accountabilities

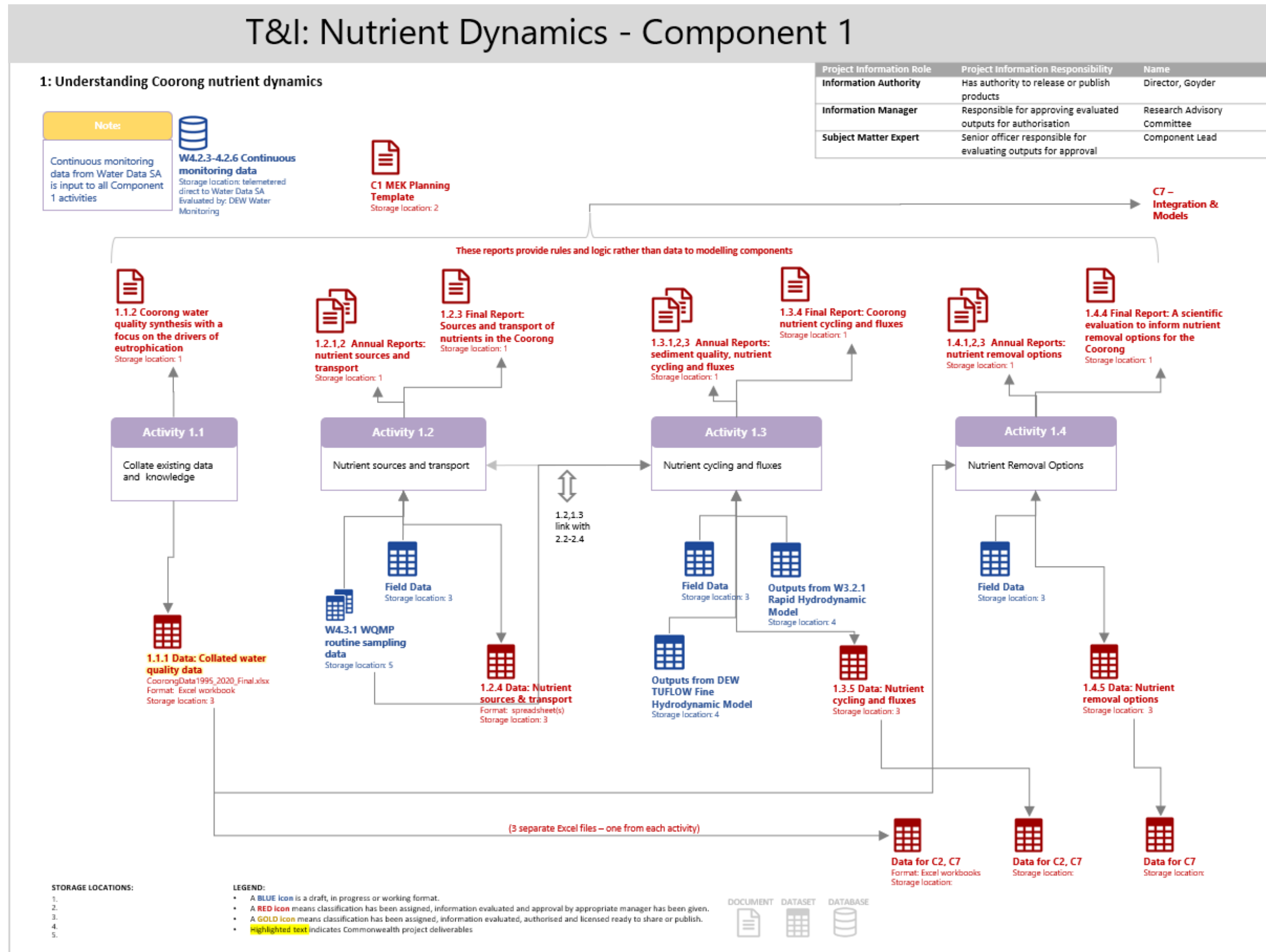| Project Information Role	Project information Responsibility	Name	Position
Information Authority	has authority to release or publish products		
Information Manager	responsible for approving evaluated outputs for authorisation		
Subject Matter Expert	senior officer responsible for evaluating outputs for approval	------------	Associate Professor, University of Adelaide
Author	responsible for creation, production and completion of scientific technical outputs	------------	Associate Professor, University of Adelaide
Knowledge Management Advisor	provides assistance and guidance for project data and information management		

Environmental Knowledge INPUTS: Data and information sources (Ownership, sensitivities, and management may vary for each input type)

Input Description	Information Type	Storage Location	Issues	MEK ID
Water quality data	Existing data from other sources	Box secure file storage	AWQC data from multiple sources, has been collated with metadata and python script	1.0
Sediment quality data	Newly collected data / information	Box secure file storage	None identified	1.0
Water isotope data	Newly collected data / information	Box secure file storage	None identified	1.0

Environmental Knowledge OUTPUTS: Data, information and knowledge produced will be managed as below

Output Description	Output Formats	Users or Audiences	Storage location during delivery	Storage location once archived	MEK ID
Water quality synthesis	database	DEW, modelling team	Box secure file storage	UoA BOX secure file storage, DEW secure storage system, public repository associated with proposed journal article	1.1.1
Water quality synthesis	document	DEW, modelling team, public	Box secure file storage	Goyder website, DEW website link, proposed journal article	1.1.2
Sediment quality data	database	DEW, modelling team	Box secure file storage	UoA BOX secure file storage, DEW secure storage system	1.3.5
Sediment quality data	document	DEW, modelling team, public	Box secure file storage	Goyder website, DEW website link, proposed journal article	1.3.4
Water isotope data	database	DEW, modelling team	Box secure file storage	UoA BOX secure file storage, DEW secure storage system	1.2.4
Water isotope data	document	DEW, modelling team, public	Box secure file storage	Goyder website, DEW website link, proposed journal article	1.2.3

C. **Example MEK chart for T&I Component 1 Nutrient dynamics, illustrating cross-referencing of Commonwealth deliverable identifiers in yellow highlight**
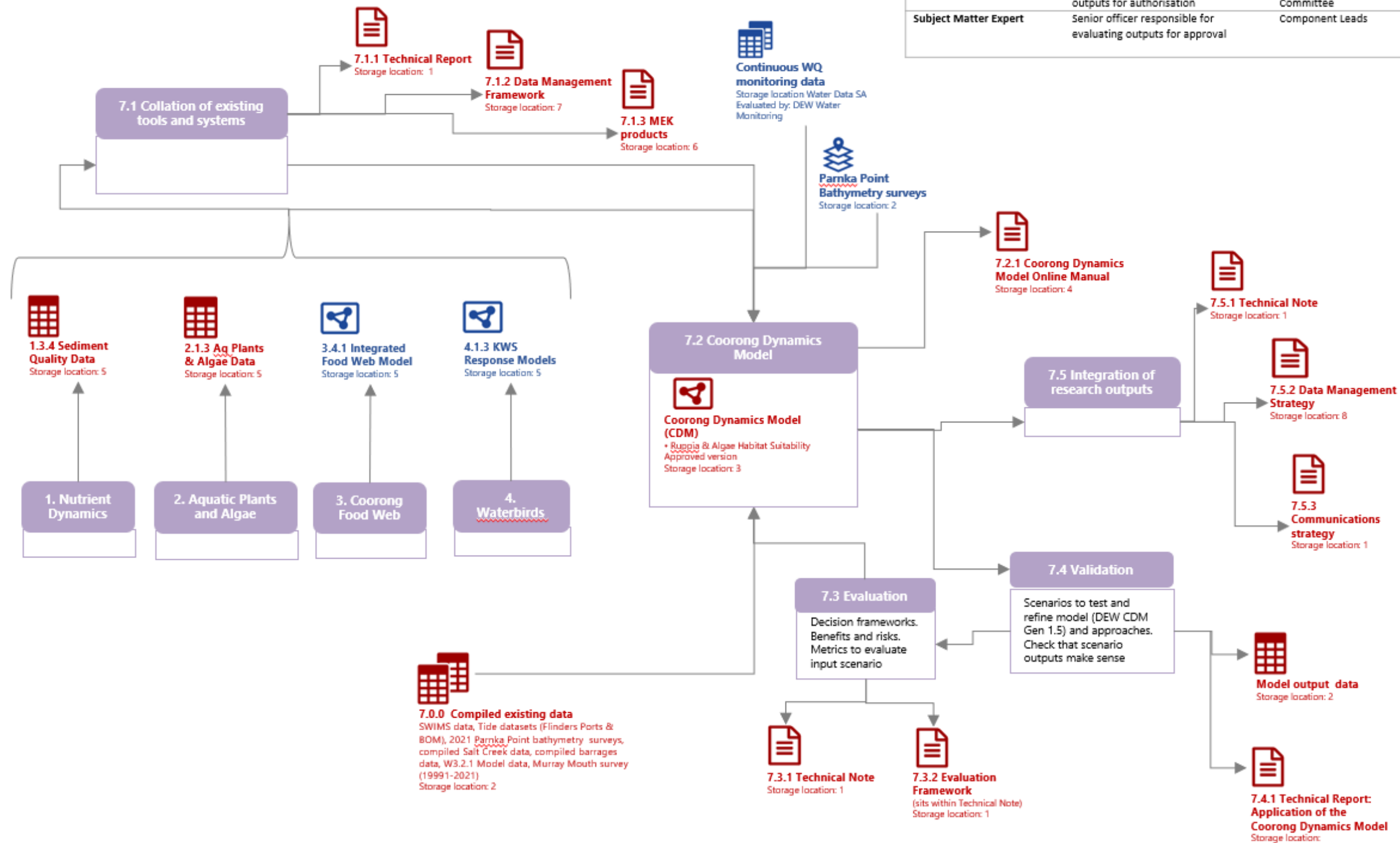
D. **MEK chart for T&I Component 7 Knowledge translation and integration. Flows of data into the Coorong dynamics modelling environment**

HCHB T&I Integration: Component 7

7 Knowledge translation, application and integration to support site management

Project Information Role	Project Information Responsibility	Name
Information Authority	Has authority to release or publish products	Director, Goyder
Information Manager	Responsible for approving evaluated outputs for authorisation	Research Advisory Committee
Subject Matter Expert	Senior officer responsible for evaluating outputs for approval	Component Leads

7.1.1 Technical Report
Storage location: 1

7.1.2 Data Management Framework
Storage location: 7

7.1.3 MEK products
Storage location: 6

7.1 Collation of existing tools and systems

Continuous WQ monitoring data
Storage location Water Data SA
Evaluated by: DEW Water Monitoring

Parnka Point Bathymetry surveys
Storage location: 2

7.2.1 Coorong Dynamics Model Online Manual
Storage location: 4

7.5.1 Technical Note
Storage location: 1

1.3.4 Sediment Quality Data
Storage location: 5

2.1.3 Aq Plants & Algae Data
Storage location: 5

3.4.1 Integrated Food Web Model
Storage location: 5

4.1.3 KWS Response Models
Storage location: 5

7.2 Coorong Dynamics Model

Coorong Dynamics Model (CDM)
• Ruppia & Algae Habitat Suitability
Approved version
Storage location: 3

7.5 Integration of research outputs

7.5.2 Data Management Strategy
Storage location: 8

7.5.3 Communications strategy
Storage location: 1

1. Nutrient Dynamics

2. Aquatic Plants and Algae

3. Coorong Food Web

4. Waterbirds

7.4 Validation

Scenarios to test and refine model (DEW CDM Gen 1.5) and approaches. Check that scenario outputs make sense

7.3 Evaluation

Decision frameworks. Benefits and risks. Metrics to evaluate input scenario

Model output data
Storage location: 2

7.0.0 Compiled existing data
SWIMS data, Tide datasets (Flinders Ports & BOM), 2021 Parnka Point bathymetry surveys, compiled Salt Creek data, compiled barrages data, W3.2.1 Model data, Murray Mouth survey (19991-2021)
Storage location: 2

7.3.1 Technical Note
Storage location: 1

7.3.2 Evaluation Framework
(sits within Technical Note)
Storage location: 1

7.4.1 Technical Report: Application of the Coorong Dynamics Model
Storage location:

STORAGE LOCATIONS:
1.
2.
3.
4.
5.

LEGEND:
- A **BLUE** icon is a draft, in progress or working format.
- A **RED** icon means classification has been assigned, information evaluated and approval by appropriate manager has been given.
- A **GOLD** icon means classification has been assigned, information evaluated, authorised and licensed ready to share or publish.

DOCUMENT DATASET DATABASE MODEL SPATIAL

E. Example MEK data catalogue for T&I Component 1 Nutrient dynamics

MEK Catalogue

Program/Project Name: **HCHB Trials & Investigations**

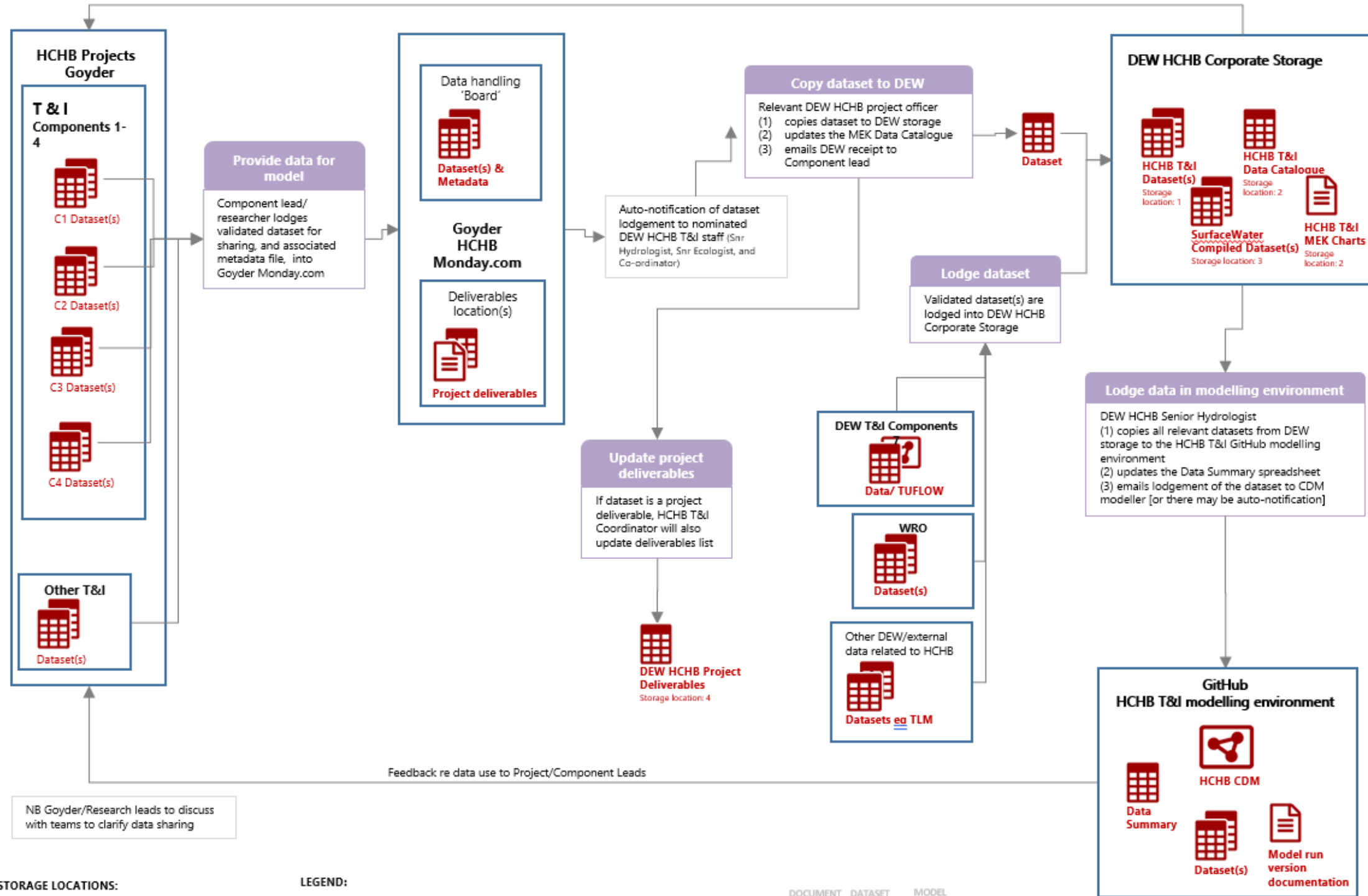|	RESOURCE DETAILS							CUSTODIAN		
ID	Document Title/Dataset Name	Format	Description	Upstream Publication	Keywords	Status	Series	Custodian Organisation	Author/ Contact	Contact Position
1.1.1	Database (excel workbooks) of collated water quality data, sediment quality data, nutrients data	Dataset	Data collated related to nutrient dynamics in the Coorong: existing data including nutrient source and dynamics in the Coorong, nutrient cycling processes in marine-hypersaline lagoons, links between nutrient availability and filamentous algae growth in estuaries. Also site maps.					Uni. of Adelaide	------------	Associate Professor
1.1.2	Coorong water quality synthesis with a focus on the drivers of eutrophication	Document	Synthesis report on data collated related to nutrient dynamics in the Coorong: Collation of existing knowledge and data, including a review and integration of nutrient source and dynamics in the Coorong, nutrient cycling processes in marine-hypersaline lagoons, links between nutrient					Uni. of Adelaide	------------	Associate Professor
1.2.1	Annual investigations report: nutrient sources and transport (2020)	Document	Reporting on findings produced during previous year related to Coorong nutrient sources and transport (2020)					Uni. of Adelaide	------------	Senior Lecturer
1.2.2	Annual investigations report: nutrient sources and transport (2021)	Document	Reporting on findings produced during previous year related to Coorong nutrient sources and transport (2021)					Uni. of Adelaide	------------	Senior Lecturer
1.2.3	Sources and transport of nutrients in the Coorong	Document	Final Report: Coorong nutrient sources and transport (including nutrient concentrations in various source waters, nutrient transport in the Coorong, and a nutrient budget).					Uni. of Adelaide	------------	Senior Lecturer
1.3.1	Annual investigations report: sediment quality, nutrient cycling and fluxes (2020)	Document	Reporting on findings produced during previous year: Coorong nutrient cycling and fluxes (2020)					Uni. of Adelaide	------------	Associate Professor
1.3.2	Annual investigations report: sediment quality, nutrient cycling and fluxes (2021)	Document	Reporting on findings produced during previous year: Coorong nutrient cycling and fluxes (2021)					Uni. of Adelaide	------------	Associate Professor
1.3.3	Annual investigations report: sediment quality, nutrient cycling and fluxes (2022)	Document	Reporting on findings produced during previous year: Coorong nutrient cycling and fluxes (2022)					Uni. of Adelaide	------------	Associate Professor
1.3.4	Coorong nutrient cycling and fluxes	Document	Final Report: Coorong nutrient cycling and fluxes (including rates and nutrient concentrations that can be incorporated (including parameterising) into the biogeochemical model that will be validated in assessing scenarios to inform site management decisions (e.g. environmental water					Uni. of Adelaide	------------	Associate Professor
1.4.1	Annual investigations report: nutrient removal options (2020)	Document	Reporting on findings produced during previous year: Coorong nutrient removal options (2020)					Uni. of Adelaide	------------	Associate Professor
1.4.2	Annual investigations report: nutrient removal options (2021)	Document	Reporting on findings produced during previous year: Coorong nutrient removal options (2021)					Uni. of Adelaide	------------	Associate Professor
1.4.3	Annual investigations report: nutrient removal options (2022)	Document	Reporting on findings produced during previous year: Coorong nutrient removal options (2022)					Uni. of Adelaide	------------	Associate Professor
1.4.4	A scientific evaluation to inform nutrient removal options for the Coorong	Document	Management guidance and recommendations on the Coorong nutrient removal options.					Uni. of Adelaide	------------	Associate Professor

F. **MEK chart for HCHB T&I component dataset management and transfer process**

T&I: Data Exchange Management Process

Data exchange management process: Overview
This workflow is primarily for datasets agreed to be shared with modelling team etc. (not for all data and formal deliverables)

7   Glossary

CDM — Coorong Dynamics Model

DEW — Department for Environment and Water

GIS — Geographic Information System; computer software linking geographic data (for example land parcels) to textual data (soil type, land value, ownership). It allows for a range of features, from simple map production to complex data analysis

Governance (of data and information) — Describes how evaluation and approvals are applied to the data outputs

HCHB — Healthy Coorong, Healthy Basin

MEK — Managing Environmental Knowledge. The Department for Environment and Water's MEK resources enable effective management of environmental and natural resources data and information within projects. They ensure project data are aligned with the department's Information Management Framework

Metadata — Descriptive properties that provide information about an item or its contents, e.g. the quality and accuracy of the data, and contact details to obtain the data. Metadata facilitates cataloguing and enables people to assess whether the data is suitable for an intended application

Monitoring — (1) The repeated measurement of parameters to assess the current status and changes over time of the parameters measured (2) Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals, and other living things

Open data — Providing unrestricted data and information to everyone. This promotes innovation and new business opportunities through the reuse of data and allows greater transparency

Provenance (of data and information) — Illustrates where the data originated and how the data inputs are transformed into other types of data outputs

SARDI — South Australian Research and Development Institute, the research arm of the South Australian Department of Primary Industries and Regions (PIRSA)

T&I — Trials and Investigations, a project under the Healthy Coorong, Healthy Basin Program from 2020-2022

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