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NATURAL RESOURCES COMMISSION

REVIEW OF NSW RESOURCE CONDITION MER

CMA INTERVIEWS - SUMMARY OF FINDINGS

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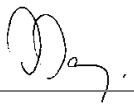
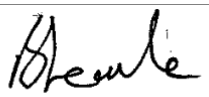
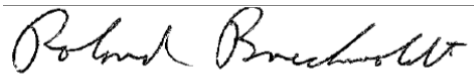
Author	Denise Day	
Checker	Brad Searle	
Approver	Roland Breckwoldt	
Report No	1	
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APPENDICES

1 SUMMARY OF FINDINGS

General comments:

- CMAs are data users and suppliers. Most CMAs have commissioned their own data collection to address data gaps or deficiencies (mostly relating to the scale of data collected through the state-wide MER Program) and have shared it with other stakeholders (e.g. councils).
- A common theme raised by CMAs in the interviews was that state-wide MER Program was not linked to investment, that is, the Program has not been interested in investment-scale information. Agencies are more concerned about NRM condition or state at a particular time. However, CMAs are primarily interested in detecting change and assessing progress towards targets.
- An underlying issue is the lack of awareness and understanding of all the available datasets. CMAs stated that it is impossible for a dataset to be of use if they do not know about it and/or do not know what is possible to analyse to answer specific questions. It was noted that data analysis requires specialised skills that are not available within most CMAs.
- A large number of CMAs stated that obtaining datasets from agencies and/or data custodians had been difficult. Furthermore, obtaining information about the dataset, such as the location/ coordinates of monitoring sites, was also difficult.
- A state-coordinated approach is necessary to ensure data is collected and analysed using consistent processes. Monitoring protocols/ standards need to be developed that are relevant to all scales e.g. Riverstyles, soil landscape mapping. Everyone is collecting essentially the same data differently which makes it difficult to aggregate data. Intervention-based monitoring protocols/ methods would be of particular value.
- The lack of tools and/or approaches to integrate datasets across NRM themes has been a barrier for CMAs to improve landscape function and resilience analysis in upgrading their CAPs.

Gaps and limitations of datasets:

- The primary datasets being used by CMAs include:
  - vegetation extent, condition and communities, however, the availability of appropriate data is limited
  - soil condition and soil landscapes
  - landuse mapping
  - water quality (macroinvertebrates, fish, water chemistry)
  - riverine condition (Riverstyles)
  - National Parks and State Forests layers.
- Most datasets are patchy across the state resulting in some CMAs having good coverage and scale, while for other CMAs the same dataset has been of limited value.
- Greatest gaps in availability of data were in relation to the Fauna, Threatened Species, Community (Targets 12 and 13) and Groundwater themes.
- Limited mapping of vegetation class/community was also identified as an issue, particularly for CAP updates and for prioritising locations to target investment. Limited data was also available for most catchments in relation to vegetation condition.

- CMAs collect vegetation condition data through the BioMetric tool when preparing PVPs. This data has the potential to be aggregated and used. However, it cannot be extracted back from PADACS. This is important considering the lack of data being collected through the MER Program.
- Several CMAs highlighted that the NRC needs to take a precautionary approach to rationalising datasets. Most CMAs are currently initiating their CAP update which applies a landscape function and resilience framework. Hence most are unsure at this stage what data will be of value and what will not.
- CMAs did note that this initial feedback was indicative and that further gaps and issues were likely to be identified once the CAP upgrade had progressed.
- Many CMAs raised concerns that State of the Catchment (SoC) reporting only incorporated data that was consistent across NSW and did not utilise all the data available for a catchment, even when it was provided by the CMA. “Data flows down, but data being fed up is not being used”.
- CMAs stated that detailed information regarding monitoring program, such as the location of monitoring sites, frequency of monitoring and longevity of the dataset, is required in order to determine the value of the dataset.

CMA MER data collection:

- Despite most CMAs stating that they did not believe that it was their role or responsibility to be collecting condition data, it has not been uncommon for CMAs to commission state agencies and other consultants to collect benchmark data at a finer scale or in areas where data was not available or insufficient.
- There is reasonable variability in the level and focus of NRM monitoring effort across NSW CMAs. Some CMAs have spent significant money and effort in collecting baseline data, conducting on-going monitoring of NRM condition and undertaking intervention-based monitoring, while for others the MER effort and resourcing has been more limited. Factors that influence this variability include:
    - Having an MER Officer engaged
    - MER Officer is funded through recurrent budget or project budget
    - Organisational culture and priorities
    - Existing data availability and the extent of gaps
    - The availability of funding for MER.
- Most CMAs have a formal process for identifying and prioritising MER data collection, including the use of Program Logic or evidence plans. Factors influencing priority include the level of investment (for performance monitoring), relevance to CAP targets and the risk associated with not having the data. Factors that influence the feasibility of collecting data include the cost and potential to establishing monitoring partnerships.

2 INTRODUCTION

The NRC has been tasked under the NSW Monitoring, Evaluation and Reporting Strategy and its associated implementation plan to provide advice to the NSW Senior Officers Group on where to prioritise its monitoring, evaluation and reporting (MER) efforts, in particular around indicators and their associated datasets.

An initial review by the NRC to ascertain the range and number of indicators and datasets in use under the NSW natural resource condition MER program for the 13 state-wide targets identified up to 97 indicators and 213 datasets associated with these indicators. Many of the datasets are essentially 'contextual' and are used to analyse and interpret the condition of natural resources and the pressures on them. For example, the *NSW land-use map*, *NSW soil profile records* and *soil landscape map series sheets* datasets are used for soil condition indicators.

The NRC has developed the document *Issues Paper - Review of NSW Resource Condition MER* (NRC, 2011) that sets out the lines of inquiry, criteria and questions the NRC will explore in developing its advice to the NSW Seniors Officer Group. As part of its review process, the NRC will interview key natural resource MER users and suppliers, including CMA staff.

The overall aim of the review is to provide advice to the Senior Officers Group regarding the focus of MER effort over the next five years.

2.1 Purpose

The purpose of this report is to collate information relevant to the NRCs lines of inquiry, criteria and questions from the perspective of the NSW Catchment Management Authorities (CMAs). In particular, the aim is to identify:

- How useful existing MER indicators and datasets are for CMA decision-making processes (e.g. investment priorities) and evaluation questions regarding the impact of management actions.
- The value of existing MER indicators and datasets for providing an understanding of landscape function and resilience assessment at a range of scales.
- How effective existing MER indicators and datasets are in meeting user needs, and their ongoing relevance to CMA processes, such as updating Catchment Action Plans.
- If the existing MER indicators and datasets are perceived as being cost effective for the benefits they generate, and the implications for CMAs if the data was not collected.

2.1.1 Structure of this report

1 **Summary:** provides an overview of the key findings

2 **Introduction:** provides the background to the NRC review and the purpose of this component of the review, as well as the approach applied to collecting and assessing the information from CMAs

3 **Findings:** these have been presented according to the lines of inquiry, criteria and questions presented in the Issues Paper (NRC, 2011).

Appendices

2.2 Approach

Telephone interviews were conducted with thirteen Catchment Management Authorities (CMAs) to identify and document information against the NRCs issues paper lines of inquiry, criteria and questions. Interviews were undertaken with the CMAs Monitoring, Evaluation and Reporting (MER) Officer and at least one Program Manager together. The roles of the CMA staff who participated in the interviews are listed in Table 1.

To ensure a considered and consistent approach to the interviews a questionnaire (see Appendix A) was developed to address the lines of inquiry, criteria and questions set out in the Issues Paper (NRC, 2011). Information on CMA resource condition datasets and indicators (or other related knowledge products) was also collated, as available.

Table 1: CMA staff positions interviewed

CMA	Staff positions interviewed
Central West (CW)	MER Officer Program Manager (Strategy and Planning)
Murray	Catchment Officer - Monitoring, Evaluation, Reporting & Planning Program Manager Program Manager
Lower Murray Darling (LMD)	General Manager
Hawkesbury-Nepean (HN)	Program Manager - Program Development GIS Officer Catchment Officer (CAP)
Sydney Metropolitan (SM)	General Manager Catchment Officer - Planning
Lachlan	Catchment Officer Catchment Coordinator – Monitoring and Resource Planning
Border Rivers-Gwydir (BRG)	MER Officer GIS Officer Program Manager, Planning and Engagement
Hunter-Central Rivers (HCR)	Business Manager – Investment Project Officer
Murrumbidgee	A/ Program Manager for Sustainable Ecosystems A/ General Manager
Northern Rivers (NR)	Program Manager MER Officer
Southern Rivers (SR)	Catchment Coordinator (Implementation) GIS Officer MER Officer
Western	Operations Manager General Manager
Namoi	Catchment Coordinator Monitoring and Evaluation

Information collated through the interviews was reviewed and analysed to identify the indicators and datasets of value to CMA decision making and common issues and data gaps. A report of the overall findings was developed against the lines of inquiry, criteria and questions.

CMAs were also provided with a spreadsheet of all the indicators and datasets identified in the Issues Paper and asked to show which had been used by the CMA in the past, and for what purpose (e.g. developing CAP, monitoring targets, preparing PVPs). CMAs were also requested to identify which of the datasets would be of use for decision making had they been aware that the datasets existed and were readily available.

The findings presented in this report represent the information and opinions provided by CMA officers during the interview and/or follow up discussions.

3 FINDINGS

3.1 Line of Inquiry 1 - Usefulness

This line of inquiry investigates the usefulness of the NSW natural resource condition indicators and associated datasets for CMA decision-making. In particular, how useful the indicators and datasets are for informing CMA decisions such as establishing CAP targets, resource allocation and measuring the impact of past actions.

Key findings:

1. CMAs are data users and suppliers. Most CMAs have commissioned their own data collection to address data gaps or deficiencies and have shared it with other catchment stakeholders.
2. An underlying issue is the lack of awareness and understanding of all the available datasets. CMAs stated that is impossible for a dataset to be of use if they do not know about it and/or do not know what is possible to analyse to answer specific questions.
3. A common theme raised by CMAs was that state-wide MER Program was not linked to investment, that is, the Program has not been targeted at investment-scale information. Agencies are more concerned about NRM condition or state at a particular time. However, CMAs are primarily interested in detecting change and assessing progress towards targets.
4. The CMAs involved in the Practical Partnerships program for native vegetation and soils viewed it as an excellent initiative that does link state-wide condition data to local scale data, as well as linking condition data to management actions.
5. Greatest gaps in availability of data were in relation to the Fauna, Threatened Species, Community and Groundwater themes.
6. The key issues in relation to Targets 12 and 13 is the lack of socio-economic data available at a catchment scale and CMA capacity to undertake socio-economic analysis.

3.1.1 CMA MER data role: MER data user/supplier

Of the 13 CMAs interviewed 10 stated that the CMA was a user and supplier of MER data, while two are data users (i.e. use data collected by state agencies only) and one a data supplier (i.e. collect their own data and do not use state agency data).

In general data is supplied for not-for-profit projects and the user may be required to sign a data licence. CMAs provide MER data to the following data ‘users’:

- Local government
- Landcare groups
- Aboriginal community groups consultants
- Community groups and individuals
- Consultants
- State agencies, including the MER Theme Teams
- Federal government agencies (e.g. for environmental watering plans).

Examples:

Central West CMA: commissioned benchmark mapping of vegetation extent within the catchment. This data was also used by Bathurst regional Council in preparing a vegetation management plan.

Murray CMA: undertook fish monitoring in the Edward-Wakool system to generate baseline data on fish movements and populations in response to flows. Data was supplied to DPI to promote adaptive management in the design of environmental flows for the system.

Southern Rivers CMA: provided wetland extent and condition data and Monaro grassland maps to local councils for the development of their Local Environment Plans (LEPs).

Namoi CMA: provided a number of datasets for Strategic Regional Landuse Planning (SRLP), a whole of government program being led by the Department of Planning (DoP). Datasets included the following spatial maps: vegetation extent (including pre-European), wetland condition and extent, groundwater dependent ecosystems, floodplains, threatened species and biodiversity assets.

3.1.2 Existing uses of state-wide MER indicators & datasets

CMAs were provided with a spreadsheet of all the indicators and datasets identified in the Issues Paper (NRC, 2011) and asked to show which had been used by the CMA and for what purpose. CMAs were also asked to state which of the datasets may be of use for decision making had they been aware of it.

This is only indicative of what may be useful to CMAs as the title of some datasets are vague, and to assess the real value most CMAs stated that they would require further details of the monitoring program, such as the location of monitoring sites, frequency of monitoring and longevity of the dataset.

An overview of the datasets discussed in more detail during the interview is provided in Appendix B.

Issues raised by CMAs:

1 A key issue is the need for a greater understanding of the datasets, in particular information in relation to the following needs to be available:

- the scale of the data and the context that it is relevant to, such as local, sub-catchment, regional, catchment, state-wide
- the number and location of monitoring sites in each catchment
- details of the monitoring and evaluation methods applied
- the frequency of data collection
- the timeframe data has been collected over
- any significant gaps in the data.

2 A greater understanding is required as to how MER datasets can be analysed. For example, if the sample size is sufficient to compare different parts of a catchment, or if the location of sampling points is appropriate for pairing to intervention monitoring sites. This understanding of the capacity of a dataset to be analysed for various purposes is essential in assessing the 'usefulness' of the dataset. CMAs noted that generally they do not have staff with the specialised skills required for data analysis and detailed discussion with the data custodian or agency officer with appropriate skills is essential.

3 A large number of datasets provide modelled data only (issues with accuracy).

4 Several CMAs highlighted the crucial link to NRM models in the usefulness of datasets. CMAs indicated that better models were required, particularly for integrating information across themes, and that the NRM model input data requirements would to an extent dictate what is of value to be collected. Other comments in relation to NRM models and decision support tools included:

- TOOLS2 modelling uses datasets available for Hunter-Central Rivers catchment. However, Western CMA noted that as there is limited input data available for the catchment the tool is not feasible to use.
- The lack of suitable models and limited longevity due to poor on-going financial support and skilled operators to run models is problematic. For example, SCARPA is the core approach used by Murrumbidgee CMA for property planning. However, this is tool poorly resourced and there is concern regarding the on-going commitment to maintaining and updating the system.
- The model, datasets and decision-making processes used in the State Biodiversity Strategy for funding are not relevant to the rangelands in western NSW as the use of native vegetation cover/ extent as a proxy for biodiversity does not apply. As biodiversity priorities and funding were based on native vegetation cover there is a concern that the western area would be poorly represented through the Strategy.

5 Murray CMA noted the importance of integrating datasets held by Victorian, ACT and federal agencies, particularly those relating to water, to CMAs within the Murray-Darling Basin (MDB). Agencies identified included Arthur Riley Institute, VIC DPI, VIC DSE, Murray-Darling Institute and the MDBA.

3.1.3 Gaps in indicators or datasets

The key gaps and issues associated with existing MER indicators and datasets, as identified by CMAs, are presented in Table 2. It should be noted that this list is not comprehensive as interview time restraints did not allow for detailed discussion of every dataset used by each CMA. CMAs also noted that their input was indicative only, and that further gaps and issues were likely to be identified once their CAP upgrade had been finalised.

Table 2: Gaps and issues with existing state-wide MER indicators and datasets

Dataset	CMA	Gaps and/or Issues
Threatened species/ Fauna	CW	Scale too coarse; no detailed ground-truthing or mapping Data on location of threatened species dubious
	LMD	Not aware of any indicators 'useable' for the catchment
	BRG	Very little available data. Using vegetation as a surrogate for fauna
	Murrum	Data is very patchy
	NR	No data available
	Western	Poor data availability Models & methods do not apply to the catchment
	HN	Limited data; SoC outputs skewed as based on OEH programs such as fox impacts on rock wallabies
Fish condition index	CW	Not able to supply whole dataset
Invasive species	CW	Scale too course; no detailed ground-truthing or mapping Focus of mapping is on production weeds. Need more information on

Dataset	CMA	Gaps and/or Issues
		invasive species that impact ecosystems & threatening processes
	HN	Scale too course Limited species included
Wetlands	CW	Scale too coarse
	SM	No fish data or indicators of connectivity
Groundwater	CW	Gap; no data on GDEs and groundwater sources available for catchment
Native vegetation condition	CW	No vegetation condition mapping in catchment
	Murrum	Very limited data
Native vegetation communities	Western	No Keith & Simpson mapping available
Landuse mapping	Murrum	Significant gaps in mapping & scale too coarse Needs to be updated periodically
Land capability	SM	Three data points in catchment
Soil condition	SR	No alignment between surveillance & intervention sites
Groundcover	LMD	Not available for catchment; would be useful due to extensive grazing
	Western	Need good information as groundcover is the primary factor driving sustainability Key intervention is management of grazing pressures
Marine habitat mapping	HCR	No information available Marine 'health' indicators need to be identified Coastal CMAs undertook a $700k marine habitat mapping project
	SM	Does not include SM catchment
Marine protected areas	SM	Too many assumptions to be useful
NRM capacity	CW	
	NR	No data available for existing indicators
Cultural indigenous data	HCR	Not available
Economic data	CW	Gap; no data
Fire	HCR	No data on location, frequency & intensity
Imagery (satellite & aerial photographs)	HCR	Not available due to licensing issues (not cross-agency). CMA has had to purchase or use Google Earth
Pollution data	HCR	Particulate matter (air & water); nutrients
Climate	HCR	Not available at a useful scale

Many of the CMAs, in particular inland CMAs, identified that many data sets did not apply to them for the following reasons:

- data was not collected for the catchment, or applied to only part of the catchment
- data was too 'crude' and was not at a fine enough scale for their purpose (e.g. to compare and prioritise vegetation communities)
- the limited number of datasets that comprise the time-series data necessary to assess change and trends
- the data collected was not relevant to CMA CAP targets or management questions
- the dataset was too old to be relevant (this was particularly pertinent where data needed to be used as a baseline).

A common theme in the CMA interviews was that the state-wide MER Program is not linked to intervention or investment, and that the Program has not been interested in integrating investment-scale information. One CMA summed it up by stating that: *"agencies are more concerned about NRM condition (or state) at a particular point in time, whereas CMAs are more interested in knowing if they are heading in the right direction".*

Related to the above is a lack of alignment in relation to scale and purpose between state-wide NRM targets, CAP targets and MER datasets. The 'questions' at a state level were not seen as being relevant at a local and catchment level.

The CMAs involved in the Practical Partnerships program for native vegetation and soils viewed it as an excellent initiative that does link state-wide condition data to local scale data, as well as linking condition data to management actions. Participation in the program has been variable with some CMAs receiving proactive support from participating agencies, while others had not been consulted. Concerns were also raised regarding the level of on-going financial support for the initiative. One CMA indicated that they had taken over the cost of monitoring at state-wide sites due to insufficient agency resources and the value of the data in understanding the impact of interventions.

A large number of CMAs stated that obtaining datasets from agencies and/or data custodians had been difficult. Furthermore, obtaining information about the dataset, such as the location/ coordinates of monitoring sites was also difficult.

Despite most CMAs stating that it was not their role or responsibility to be collecting condition data, it has not been uncommon for CMAs to commission state agencies or other consultants to collect benchmark data at a finer scale or in areas where data was not available or insufficient.

Many CMAs raised the issue that SoC reporting only incorporated data that was consistent across NSW and did not use all the data available for a catchment, even when it was provided by the CMA. *"Data flows down, but data being fed up is not being used"*.

CMAs collect vegetation condition data through the BioMetric tool when preparing PVPs. This data has the potential to be aggregated and used. However, it cannot be extracted back from PADACS. This is important considering the lack of vegetation condition data being collected through the MER Program.

3.1.4 Targets 12 and 13

Many CMAs combine the state-wide targets NRM Capacity and Economic Sustainability and Social Well-Being into an overall theme of 'Community'. As such, it was difficult to tease out information regarding these issues separately.

Regarding the indicators used and outputs prepared for State of the Catchment (SoC) reporting, all of the CMAs stated that the data had not been of use and many did not understand the relevance of some of the indicators. Some CMAs stated that the framework of five capitals used for understanding NRM Capacity was a good approach, but was expensive to resource, while other CMAs found it difficult to determine what the outputs actually mean.

Unlike other themes, the CMAs tended to focus the interview discussion on the range of questions they had of how to understand and engage their community. This included a need for further knowledge on the current status of their community (practices, values, skills, etc), the best approaches to engage their communities to increase NRM capacity and promote practice change (program design, appropriate messages and incentives) and how they could better understand what has been achieved. The key socio-economic questions expressed by CMAs are presented in Table 3.

Although many CMAs have undertaken their own social benchmarking surveys (CW, LMD, Murray, BRG, Murrumbidgee, SR, Western, Namoi) and/or have collected their own data, they also acknowledged that they required a lot more assistance in understanding the socio-economic implications and impacts of their work. In particular, the need for a detailed understanding of the demographics of stakeholder groups was identified as essential to ensuring appropriate engagement. This includes factors such as income and education, as well as urban and rural variability.

Namoi CMA is currently implementing a project to benchmark social well-being and adaptive capacity indicators. The literature review is complete and a benchmarking survey is underway.

Table 3: 'Community' related questions and potential indicator and/or datasets

NRM Capacity	Economic Sustainability & Social Well-Being
Questions identified by CMAs	
▪ What is the current attitude of the community to NRM? ▪ Who to target? ▪ What programs or design aspects work for increasing NRM capacity? (e.g. peer pressure, critical mass, weight of evidence, core messages) ▪ What factors drive a shift in behaviour? ▪ How do you know if you are heading in the right direction? ▪ What is the extent & distribution of different land management practices? ▪ What factors drive council behaviour?	▪ Why are people leaving the catchment and where are the moving to? ▪ How to keep young people on the land? ▪ How to support Aboriginal landowners to increase land profitability and employment?
Indicators and datasets identified as being of value	
▪ Australia Bureau of Statistics data ▪ ABARE data/ reports ▪ Bureau of Rural Sciences Social Atlas ▪ Spatial mapping of community NRM capacity and values ▪ Demographic data: age, level of education, ▪ Access to a computer ▪ Training event evaluations ▪ Volunteers (numbers, hours, area of bush care (primary & secondary) ▪ "Who cares about the environment"	▪ Australia Bureau of Statistics data ▪ ABARE data/ reports ▪ Bureau of Rural Sciences Social Atlas ▪ MDBA data ▪ CSIRO (Farming Futures) ▪ Industry data ▪ On- and off-farm incomes ▪ Population trends ▪ Land ownership (families, multinationals) ▪ 'Social' assets ▪ Tourism ▪ Land values ▪ Business viability

3.1.5 Measures of value for understanding landscape function & resilience

Many CMAs were apprehensive about identifying specific indicators and datasets relevant to understanding landscape function and resilience in their catchment. This was primarily because most CMAs are in the initial stages of their CAP update and the data needs have not been considered or consulted in detail. Others stated that they are open to learning from CMAs who have been through the process of updating their CAP. The measures that were identified by CMAs are listed in Table 4.

Some of the comments related to understanding landscape function and resilience included:

- The need for state and transition models. What is the state? What are the triggers and/or thresholds? *"When looking at NRM systems and services we need to understand where on the continuum they lie and what the thresholds are"*.
- The issue is not the NRM datasets per se, but the ability to integrate them.
- Base-level datasets, such as vegetation, soils and Riverstyles, are a necessary foundation.
- Condition and trend data is essential.
- All data available should be considered in order to generate an integrated understanding.

Table 4: Measures useful in understanding landscape function and resilience

Dataset	Rationale	CMAs
Vegetation datasets - Keith Class mapping and modelling	Surrogate for biodiversity	CW, HCR, NR, LMD, Murrum, SM, Western, HN
Soil class mapping & erosion risk		CW, NR, Western
Hydrogeographic landscape mapping		CW
Riverstyles		CW, HCR, Murrum
Threatened species (regional scale)		CW
Groundcover/ soils/ wind erosion	Due to grazing activities in catchment	LMD, Western
Community	Need data to update regional profiles	LMD, SM
Demographic & socio-economic datasets		Murrum, HN
Wetland health	Prevalence & importance in catchment	Murrum
Water quality	Salinity, salt loads, algae, turbidity Affects estuaries & other ecosystems	LMD, NR SM, HN
Water quantity	Affects estuaries & other ecosystems	SM
Aquatic ecology	Fish habitat, particularly in lower stream	
Climate change	More refined scale to they are useful & meaningful	SR
Invasive species	Impacts on flora & fauna	SM
Fire	Areas prone to fire	HN

3.1.6 "Key" measures of NRM condition

CMAs were asked to identify four key 'measures' that would best capture NRM condition in their catchment (Table 5). Many were apprehensive about responding to the question prior to updating their CAP and felt that the question was "putting the cart before the horse". Another CMA stated that *"although these measures indicate what is important, it should not be taken to represent that the opinion that a handful of NRM parameters can provide a good indication of environmental health".*

Other comments included:

- The data needs depend on NRM thresholds of resilience, as well as the data inputs required for best practice models of resilience.
- Southern Rivers CMA catchment is diverse, and as such the measures will depend on the location. For example, the level of development is a valuable indicator of health for rainforest in coastal areas. However, this is not so relevant to other parts of the catchment.

Table 5: Key 'measures' of NRM condition

Aspect	Measure/ Indicator	CMA
Landscape connectivity	Riverine and vegetation cover	CW
Soil health/ condition	Groundcover and organic carbon e.g. % agricultural land still viable Land & soil capability	CW, HCR, BRG, SR NR, Murray
Water quality and quantity movement (riverine, wetland, estuary & marine)	Vegetation and water Index of waterway condition Receiving waters	CW, LMD, BRG, Murray NR, HN SM
Biodiversity assemblages	Sustainable populations Diversity & abundance Aquatic biodiversity	CW, BRG Murrum
Erosion extent		LMD, HN
Riverine condition 'index'	SRA River Health Index Index of stream condition (VIC)	LMD, HCR, Murrum, Western SR
Riverine condition	% 'naturalness' of surface water flow. Proportion of river reaches in good geomorphic condition Riparian vegetation condition health	Namoi
Vegetation	Vegetation condition and extent, connectivity Composition & structure Woody vegetation extent %. & regional vegetation class extent % thresholds	LMD, HCR, Murrum, NR, SR, HN, Murray Western Namoi
Habitat	Extent & quality	HN
"Community"	Volunteerism, community groups	HCR, LMD

Aspect	Measure/ Indicator	CMA
	Socio-economic viability	Murrum, Murray
	Sustainable, viable, engaged	NR, SM
Estuaries	Estuary health	SR
Connectivity (biophysical)	Extent & condition of corridors	SM
Groundcover	Extent & trends	Western, Namoi
Fauna	Status/ condition	Western, Murray
	Population size of individual species; Habitat area for species or population; Area of community.	Namoi
Invasives	Presence & extent of invasive species	Namoi
Groundwater	GDE health.	Namoi
	Aquifer status for beneficial uses.	
	Maximum historical drawdown not exceeded	

3.2 Line of Inquiry 2 - Feasibility

The aim of this line of inquiry is to investigate the feasibility of NSW NRM condition indicators and associated datasets for how practical and cost-effective they are to implement and deliver. As information was not available regarding the costs associated with collecting and managing state-wide datasets most CMAs were not in a position to comment. However, information was gathered regarding CMA processes associated with identifying and resourcing the collection of MER data.

Key findings:

1. Most CMAs have a formal process for identifying and prioritising MER data collection. Factors influencing priority include the level of on-ground investment, relevance to CAP targets and the risk associated with not having the data. Factors that influence the feasibility of collecting data include the cost and potential to establish monitoring partnerships.
2. There is reasonable variability in the level and focus of NRM monitoring effort across NSW CMAs. Some CMAs have spent significant money and effort in collecting baseline data, conducting on-going monitoring of NRM condition and undertaking intervention-based monitoring, while for others the MER effort and resourcing has been more limited. Factors that influence this variability include:

- Having an MER Officer engaged
- MER Officer is funded through recurrent budget or project budget
- Organisational culture and priorities
- Existing data availability and the extent of gaps
- The availability of funding for MER.

3.2.1 CMA MER investment

Table 6 illustrates how each CMA determines the need to collect additional MER data, the frequency that data needs are assessed and the key considerations in determining what monitoring and evaluation will be undertaken.

Most CMAs have a formal process for identifying and prioritising MER data collection, including the use of Program Logic, evidence plans and MER plans. Factors influencing priority include the level of investment (for performance monitoring), relevance to CAP targets and the risk associated with not having the data. Factors that influence the feasibility of collecting data include cost, staff resources and the potential to establishing monitoring partnerships.

Table 6: CMA processes for assessing the need to collect additional MER data

CMA	Basis of process	Frequency of review	Considerations in assessing the priority & feasibility of collecting MER data
CW	Evidence Plan	Annual	Potential for partnerships Risks (consequence of not having the data)
HCR	Knowledge Needs Register: review of management targets to identify knowledge gaps Knowledge Strategy; Knowledge gaps review	Annual	Cost, staff resources & skills
Murray	Program Logic is applied to identify data needs,	On-going	Priorities are based on effectiveness &

CMA	Basis of process	Frequency of review	Considerations in assessing the priority & feasibility of collecting MER data
	availability & gaps.		efficiency; which best deliver on assessing & informing objectives/targets & which are feasible Costs/ resources Skills
BRG	Decisions based on the location of projects & the statistical information regarding sample size. Evidence Library (initiated as part of CAP upgrade)	As needs basis	Relationship to on-ground actions Potential for partnerships Cost, resources, skills (mostly collected through external contracts)
Murrum	Investment Prioritisation Business System: decisions based on evaluation of outcomes of previous programs & their contribution to targets. Adaptive management approach.	Annually & periodically	Value as an input to models The feasibility of aggregating data from a site-regional-catchment scale Relationship to on-ground actions & collected by landholders
NR	Initial CAP: some gaps in knowledge were addressed through management actions Upgrade of CAP & data audit will identify what needs to be collected to facilitate monitoring CAP targets	Annual	Relationship to on-ground actions & collected by landholders
Lachlan	Evaluation & MER Plan: assess the impact of major investments	Annual	Level of investment Continuity of investment Significance of the evaluation question
SM	No formal process. Anticipating that CAP update will identify gaps	As needs basis	Size of program/ level of investment Available budget External expertise
Western	No formal process other than M&E Plan & project review team. Plan to undertake evidence collection & information management as part of CAP update	Annually	Available budget Value for money Access
HN	Project-level monitoring only	Annually	Select 10% of on-ground projects >$30k & catchment protection projects with a value >$100k
Namoi	CAP development and CAP update used to identify gaps & priorities. Decision support tools Resource condition monitoring (1, 5 & 10 years) at each intervention site using standardised protocols	CAP & funding cycles	Availability of funding Cost of M&E M&E methods available CAP priorities

3.2.2 CMA MER datasets

There is reasonable variability in the level and focus of NRM monitoring effort across NSW CMAs. Some CMAs have spent significant money and effort in collecting baseline data, conducting on-going monitoring of NRM condition and undertaking intervention-based monitoring, while for others the MER effort and resourcing has been more limited. Factors that influence this variability include:

- Having an MER Officer engaged – MER effort is generally driven by the MER Officer. However, some CMAs have had difficulties in filling these positions and as a result MER activities have been limited.
- MER Officer is funded through recurrent budget or project budget - those CMAs that have a permanent position for an MER Officer in their structure in general have greater annual funding available for MER. In contrast CMAs required to fund their MER Officer out of the 10% MER budget have less available for the collection of data.
- Organisational culture and priorities - although all CMAs understand the value of MER, most stated that state-wide condition/ surveillance monitoring was not their responsibility. For some CMAs this has resulted in an organisational priority and focus on the delivery of management actions and intervention-based MER only, while other CMAs have been involved in the extensive collection of baseline data, on-going condition monitoring, as well as intervention-based monitoring.

  One CMA invested substantially in collecting MER baseline data with CMA set-up funding. Continued baseline data collection has been funded through the 10% MER and 15% strategic planning budgets.
- Existing data availability and the extent of gaps - the availability and/or coverage of MER datasets relevant to some CMAs (e.g. Western) is so limited that the resources required to 'fill the gaps' would be so great that it would require a large portion of their operating budget. In these instances CMAs often rely on expert opinion to address knowledge gaps.
- The availability of funding for MER – some CMAs have been successful in obtaining funding for MER data collection through Catchment Action NSW, while others have not. Funding for condition or baseline monitoring is not available through the Caring for our Country program.

The CMA collected MER datasets identified during the interviews are presented in Appendix C. CMAs were also requested to provide a complete list of the MER data they have collected. Inventories of datasets were received from Border Rivers-Gwydir and Namoi CMAs.

Other relevant CMA documents identified through the interviews are presented in Appendix D.

3.3 General MER comments

The following comments relating to MER processes in general were also made by CMA staff during the interviews:

- A state-coordinated approach is required to ensure data is collected and analysed using consistent processes. Monitoring protocols/ standards relevant to all scales are required e.g. Riverstyles, soil landscape mapping. Everyone is collecting essentially the same data

differently which make it difficult to aggregate data. Intervention-based monitoring protocols/ methods are required to promote consistency[1].

- Need to work in a national framework, therefore, the National Environmental Accounts needs to be considered and aligned.
- Data licensing requires a cross-agency approach so that all government agencies can use the data (e.g. LiDAR, aerial photographs). CMAs have purchased imagery that is already held by other state agencies, but not available to them due to licencing limitations.
- A common data platform is needed for spatial data, such as the Spatial Information eXchange (SIX) coordinated by Land & Property Information.
- Monitoring is one approach to test an assumption, fill a knowledge gap or confirm a result. Some interventions processes are well established and can be routinely undertaken where the results or impacts are known from previous studies. In this case an established trend or outcome can be estimated with no or minimal monitoring. For example, the value of waterponding to increase groundcover and conservation grazing are examples of management actions with established outcomes. Other actions have much less supporting evidence and as such require more, or better, information. This can be achieved through reviewing the available knowledge, undertaking an evaluation or monitoring.

[1] Namoi CMA has developed and is using standardised intervention-based monitoring protocols for the monitoring of projects involving wetlands, river geomorphology and pasture assessment.

APPENDIX A

CMA QUESTIONNAIRE

NRC MER Review

CMA Consultation Questionnaire

CMA: _____ **Date:** _____

CMA Representatives: _____

_____

Position titles: _____

Hyder consultant: _____

The notes in **BLACK** are questions to be asked of the respondent.

The notes in **RED** are prompts for the interviewer.

Line of Inquiry 1: Usefulness of Indicators and datasets

Review Criterion A – Indicators and datasets linked to management/ policy/ evaluation questions

1. MER data user/supplier.

A Do you consider the CMA to be a (circle one):

- MER data user
- MER data supplier
- MER data user and supplier

For data supplied to others:

Data set	Spatially represented?	Publically available?	Supplied to?	Purpose

B For what purposes does the CMA use state-wide MER indicators/ dataset? (Prompt to cover all themes)

Purpose (e.g. CAP upgrade, prioritisation of investment, reporting outcomes, project design)	**Data indicators/ datasets that were used** (refers to external & CMA internal datasets;)	**Value/ Issues:** For <u>each</u> indicator/ dataset document: How useful/ informative is the information? Why? What are the limitations or issues (e.g. scale)? Can the indicator/ dataset be aggregated/ disaggregated to different scales?

Purpose (e.g. CAP upgrade, prioritisation of investment, reporting outcomes, project design)	**Data indicators/ datasets that were used** (refers to external & CMA internal datasets;)	**Value/ Issues:** For <u>each</u> indicator/ dataset document: How useful/ informative is the information? Why? What are the limitations or issues (e.g. scale)? Can the indicator/ dataset be aggregated/ disaggregated to different scales?

3. Gaps and Issues:

A What are the key gaps/ issues/ limitations with respect to the available MER indicators/ datasets in terms of informing decisions? (e.g. NRM issues, CAP target development and/or monitoring, scale/ location, data inputs required for decision support tools/modelling) (external MER data only; review by theme)

Theme:

Theme:

Theme:

Theme:

Theme:

B Has the CMA done anything to address these gaps/ issues/ limitations? (link to above)

C What are the key gaps/ issues/ limitations with respect to the available MER indicators/ datasets in terms of understanding impacts (performance) of investment? (e.g. frequency, format, scale/ location) (external MER data only; review by theme; refer to previous information on gaps)

Theme:

Theme:

Theme:

Theme:

D What has the CMA done anything to address these gaps/ issues/ limitations? (link to above)

Review Criterion B: Indicators and datasets provide users with a better understanding of how landscapes function at a range of scales

4. Landscape function and resilience

A What does the term landscape function mean to you?

B Is landscape function a commonly used definition/ term within your CMA? Yes/ No

In what context is it generally used?

C What does the term landscape resilience mean to you?

D Is landscape resilience a commonly used definition/ term within your CMA? Yes/ No

In what context is it generally used?

E What MER indicators/ datasets are of value for understanding landscape function and landscape resilience? (note which the response applies to)

MER indicators/ datasets	**Rationale**

D How does the CMA currently integrate MER information/ data across themes? (e.g. tools such as INFFER that integrate information)

5 Social and economic function

A What MER indicators/ datasets and/or processes are of value to your CMA for understanding the social aspects of NRM (e.g. existing capacity and gaps, level of community interest)?

MER indicators/ datasets	**Rationale**

B What MER indicators/ datasets and/or processes are of value to your CMA for understanding the economic sustainability and social well-being aspects of NRM?

MER indicators/ datasets	**Rationale**

<u>Review Criterion C</u> – Indicators and datasets evolve with users needs

A Of the current MER indicators/ datasets are there any that you feel have limited on-going relevance? (e.g. extent of marine protected areas if classification changes)

B What factors do you believe may influence the on-going relevance of the current MER indicators/ datasets? (e.g. change to state-wide targets, funding priorities, political priorities)

Line of Inquiry 2: Feasibility of Indicators and datasets

Review Criterion A – Indicators and datasets are cost effective

1. Do benefits justify investment?

A For MER indicators/ datasets provided externally which do you feel justify the investment?

MER indicators/ datasets	**Rationale** (variety of uses, range and extent of benefits)

B How does the CMA make the decision to collect additional MER data? (Who? Based on what information? How are priorities determined?)

C How frequently are NRM data needs reviewed/ considered?

D How are the costs and benefits of investing an MER data collection project assessed? (include comment on the cost of not collecting the data)

E In relation to projects how is MER currently undertaken for performance and/or condition monitoring for on-ground works?

If this information is described in your CMAs MER Plan please provide reference details and forward an electronic version of the MER Plan.

Details of the indicators and datasets collected by the CMA

A What NRM data has been collected by the CMA?

NRM data may include spatial or mapping data, studies, surveys, condition or performance monitoring, baseline data, etc. Examples of data could include:

- property scale monitoring by landholders required as part on incentive agreements;
- monitoring of size and extent of aquatic weed infestations; and
- community surveys.

Please provide a description of each data set that has been collected by your CMA.

Dataset name	**Purpose** List all the decisions, DSTs, models, project selection criteria, performance & condition monitoring programs, etc	**Process for monitoring or data collection**

<u>Review Criterion B</u> – Indicators and datasets are practical and feasible to implement

1. Feasibility

A What MER is feasible for the CMA to implement and collect at the site and catchment scale?

B What is the rationale for determining if collection of MER data is feasible? (circle as apply)

Cost

Resources (staff)

Resources (equipment)

Skills

Access

Other (specify):

What do you see as the four key "measures" to capture NRM condition in your catchment? Include the rationale:

1
2
3
4

APPENDIX B

OVERVIEW OF DATASETS USED BY CMAS

Table 7: Overview of datasets used by CMAs and current issues and limitations

Dataset	CMA	Purpose used for	Value/ issues
Native vegetation extent	CW	CAP update Draft Biodiversity Strategy	Resilience analysis: to identify vegetation extent thresholds of concern
	HCR	CAP development & update Prioritising themes Target areas for investment Identify stakeholders to engage	Good at a broad scale; not at a site level Patchy scale across LGAs & catchment (comprises approx. 50 data sets) CMA has invested heavily
	LMD	Reporting	Too coarse and not good coverage for the catchment
	BRG	Target areas for investment	Scale too coarse; needed to undertake own analysis to get required outputs
	Murrum	Input to modelling tools Property Management Plans Target areas for investment Project design LEPs (councils)	Additional data was commissioned to increase consistency & scale Still gaps in coverage; data is of a variable quality & erroneous for use at a farm scale
	NR	PVPs	Reasonable at a state-scale, of less value for decision making at a property or regional scale
	Lachlan	Investment planning	Used as an input for a spatial model
	SR	Target areas for investment Corridor mapping LEPs (councils)	1780 & current extent
	SM	Target areas for investment Management actions Decision support tools	Scale is too coarse; CMA has undertaken vegetation mapping to 1:4000 scale
	HN	Target areas for investment Project design (property planning)	CMA generated own layer to address gaps; lack of confidence in the derived layer Needs to be updated annually
	Murray	CAP update/ strategic planning Target areas for investment Project planning Capacity building Decision support	CMA has a seamless vegetation map that is very useful at all scales (only CMA to have) Inconsistency in vegetation community classification; Benson in west of catchment & Gillies in east
	Namoi	Biodiversity evaluation Vegetation extent thresholds for resilience assessment	Significant gaps; CMA has commissioned mapping to generate seamless vegetation maps for the whole catchment. No pre-European data available. Only recently obtained direct access to SLATS
Native vegetation communities	Murrum	Programs targeted at EECs	Poor data
	LMD	Target areas for investment	No data on vegetation classes Keith class very useful; needs to be updated

Dataset	CMA	Purpose used for	Value/ issues
	HCR	Target areas for investment Identify stakeholders to engage	Vegetation community mapping still not complete (required for CAP update)
	NR		Errors in vegetation classifications; needs more on-ground verification
Woody/ non-woody native vegetation	LMD	To determine woody weed encroachment	Too inaccurate for catchment Scale is too large
Native vegetation condition	LMD	CAP update Theme targets Investment priorities Management actions Modelling (input data)	Limited data CMA collects data for 100 sites over 3 years (now 50 sites) 6 years of data is included in the Ecosystem Function Analysis
	Murray	Outcome reporting Planning Capacity building	Prepared by CMA & ANU
	Namoi	Resilience assessment	Only available for riparian areas in parts of the catchment
Landuse maps	LMD		Too inaccurate for catchment Scale is too large
	HN	Target areas for investment	Only mapped for 75% of catchment; upper catchment good Inconsistencies in categories used for upper and lower catchment
Highly erodible soils	HCR	CAP development & update Prioritising themes Target areas for investment Identify stakeholders to engage	
Soil landscape mapping	HCR	CAP development & update Prioritising themes Target areas for investment Identify stakeholders to engage	Coverage is not consistent across catchment. CMA has commissioned work to increase coverage (not much support from OEH)
	BRG		Too coarse
	Namoi	Resilience assessment	CMA had to patch all the datasets togther
Land capability mapping	HCR		
	Lachlan	Investment planning	To test theories regarding condition of the catchment
Soil condition, salinity & waterlogging	Murrum	Prioritising themes Target areas for investment Input into Land/ Property Management Plans	Used in conjunction with water quality data Salinity (as driven by watertable rise) is not a static issue, therefore the currency of mapping is important; current collection not frequent enough Scale too coarse
Corridor modelling	CW		

Dataset	CMA	Purpose used for	Value/ issues
(not on list)			
Water quality	BRG	Long-term, times series data	
	NR	Macroinvertebrates, fish, water chemistry	Close alignment to CMA indicators Regionally patchy Many datasets have been collected as a one-off & are not of value for monitoring trends/ change Scale too coarse & interpretations are not robust
River Condition	CW		
	Murrum		Instream ecology, stability, snags, etc very patchy CMA is acquiring the hydrogeologic layer for Riverstyles
SAR stressed rivers reports	HN	Target areas for investment River health strategy	Mapping of rivers in the HN catchment is at much courser scale than rest of state; priority to upgrade
Surface water flow data	Namoi	Resilience assessment	To identify systems near the 60% threshold. NOW conducts the analysis.
Geomorphic maps (NOW)	Namoi	Resilience assessment for CAP update	Information combined with CMA vegetation mapping and Riverstyles report to determine geomorphic condition in riparian areas. NOW conducts the analysis.
Groundwater maps	Namoi	Resilience assessment	Identifying aquifers close to thresholds
Estuaries	NR		Data is appropriate for local & state-wide scale
	SR	Impact of interventions	Lack of communication; CMA wanted to provided input into the selection of monitoring sites
Wetland maps	Namoi	Inventory mapping Prioritisation	Modelled condition only; mapped remotely. CMA has undertaken on-ground verification mapping.
Macroinvertebrates	CW	CAP upgrade	
	SR	Impact of interventions	Unable to obtain location of monitoring sites (to link to intervention sites), methodology & when monitoring is being undertaken
Invasive species	Lachlan	Verification	Used for validation (e.g. when it is suspected that a species is being impacted by pest species)
	Murray	Planning & prioritisation	
National Park (national parks, reserves & state forests)	SR	Priority vegetation communities	Identify where land is already protected & managed
	SM	Input to models Target areas for investment Program design	Identify where land is already protected & managed Limited information on what management actions have been done in parks that the CMA can expand/ support Corridor mapping & areas to extend corridors
	HN		Used frequently
Kangaroo Management Plan	Western	Target areas for investment	Kangaroo monitoring includes counts of feral goats since 1992
Wildlife Atlas	SM	Target areas for investment	

Dataset	CMA	Purpose used for	Value/ issues
	Western	Program design	
Waterbird surveys	Western	Target areas for investment	
Fish barriers	HN	Target areas for investment Program design	Good dataset for prioritising barriers for removal Needs to be updated periodically
Fauna condition	Murray	Outcome reporting Planning Capacity building	Landscape scale biodiversity mapping undertaken by ANU using CfoC funding (expensive) Linked to intervention sites

APPENDIX C

DATASETS COLLECTED BY CMAS

(as identified through the interview process only)

CMA	Data set	Spatially represented	Supplied to	Purpose
Central West	Vegetation extent benchmark mapping	yes	Local government Landcare groups Aboriginal community groups Consultants	e.g. Bathurst regional Council for vegetation management plan
	Wetland extent & condition & threats	yes		Wetland condition & threats - interpretation of existing data & ground-truthing (not all wetlands covered). Prioritisation process developed for CAP update.
	River status		NOW	Will contribute to a River Condition Index. CMA catchment scale mapping & prioritisation based on resilience work. Identifying with NOW sites to be set up under the Partnerships approach.
	Project-scale monitoring data (veg & soils)	Not all project monitoring sites are mapped, however, grid references are available	OEH Vegetation & Soils Partnerships	Soil watch (soil carbon testing) - soils database Groundcover Vegetation 80-100 paired sites (intervention/ no intervention)
	Vertebrate fauna mapping			Linked to connected habitat & habitat type
	Soil landscape mapping			5 years of local-scale data collection. Greg Chapman & OEH assisted with analysis.
	Community benchmarking survey			Community attitudes, awareness & involvement in NRM. Provides a reference point for ongoing M&E for community engagement & capacity building
Lower Murray Darling	Ecosystem functionality analysis	Yes	SoC working groups	The expectation was that the analysis would be included in the SoC report, but it was not.
	Vegetation clearing & offsets	Yes	OEH & DPI Crown Lands	Tracking activities under the NV Act
	DustWatch Network	Yes	OEH	

CMA	Data set	Spatially represented	Supplied to	Purpose
	Wind Erosion Risk Management	Yes	OEH	Griffith University, Combined Research Centre for Desert Knowledge
	Alien Fish monitoring		SRA	Annual monitoring that collects data in relation to ratio native:alien, abundance, species mix. Overall aim is to determine if river systems have changed as as result of CMA interventions such as removing fish barriers & wetland reconnectivity (intervention monitoring).
	The Darling Anabranch Adaptive Management Monitoring Plan: Condition and Intervention Monitoring Program.			Targeted monitoring program to indicate how well the environmental flow regime & other management strategies are achieving the objectives, that includes monitoring of: i. water quality parameters; ii. riparian and aquatic vegetation; iii. frog and native fish populations; and iv. waterbird populations.
	Community survey			
Lachlan	DustWatch Network	Yes	OEH	Seven DustWatch gauges (Dustrak) have been installed. Two gauges have been operating since 2005 (Condobolin & Ivanhoe) as part of the state-wide dust monitoring program. Five additional gauges were set up the Lachlan in 2007 at Hillston, Parkes, Cowra, Temora & West Wyalong. These gauges are maintained by either Landholders or by CMA staff depending on location. At DustWatch gauges, dust concentration measurements are taken every 1 minute. The data from these gauges are transmitted to the dustwatch team within DECCW for collation & analysis. The dustwatch team also circulate a weekly report from this data about dust conditions across the catchment.

CMA	Data set	Spatially represented	Supplied to	Purpose
	Cowra Woodland Birds			The Lachlan CMA is helping the Cowra Woodlands Birds Survey to see how woodland birds are responding to land management in the Lachlan Slopes region. This program encompasses bird conservation concerns in the Cowra Shire and works cooperatively with local landholders, BASNA, the Lachlan CMA and other agencies. Bird surveys are conducted quarterly by volunteers over established monitoring sites within the Cowra Shire. Over 90 sites have been established & information recorded on birds present, vegetation and topography. Data from this program has generated on the correlation between birds and habitat attributes.
	Community Stream Sampling			Community stream samplers have been monitoring in the Belubula and Mandagery Creek catchments since July 2007 with a focus on salinity. There are currently 40 samplers monitoring 37 streams or rivers and in total they monitor 90 sites each month. This monitoring will assist the Lachlan CMA and the samplers by increasing awareness and knowledge of salinity. The information will help the Lachlan CMA make more informed & strategic management decisions.
	Catchment Health & Soil Monitoring			This project aims to demonstrate the benefits of specific management practices on soil health. It will: • identify change in soil parameters due to improved management practices and landholders improved knowledge & skills regarding soil conditions & health. • establish a monitoring methodology for soil moisture & soil carbon particularly targeting mixed farming systems in the Lachlan Catchment • monitor soil health parameters over time to determine changes in water use efficiency • monitor soil organic carbon due to improved management systems

CMA	Data set	Spatially represented	Supplied to	Purpose
Murray	Fauna (terrestrial)	yes	Wildlife Atlas	Fauna richness and abundance in response to intervention
	Soil condition	yes	OEH - SALIS	Baseline soil condition
	Fish (Edward-Wakool)	yes	DPI	Fish richness and abundance in response to flows
	Vegetation condition	yes	YETI	Modelling work by Ian Oliver Preparation of a seamless vegetation layer (Sivertson, Roffe, Denholm)
	Soil carbon	yes	CSIRO	Soil carbon baseline
	Water quality	yes	MDBA; Triton (?)	Analysis of water quality in response to flows
	Dust Watch (wind erosion)	yes	Uni Qld	Dust quantity in relation to groundcover and land use. Paired sites allows a comparison between control and intervention sites with respect to groundcover and dust.
	Macroinvertebrate studies			Just completed.
Northern Rivers	Economic Sustainability, Social Well-being & Capacity Building Monitoring			Project is being carried out by the Bureau of Rural Sciences ("Understanding Natural Resource Management: Issues in the Lachlan Catchment; Lachlan CMA Regional Survey; Ongoing Benchmarks for Community Attitudes and Awareness). This is the second benchmarking survey, the first was conducted in 2003. Together, these will measure how attitudes to NRM have changed since 2003 to see if our NRM programs are helping.
	Soil profile mapping	yes	OEH	Benchmark and intervention sites; supplementing state-wide data
	Water quality		uniDAP (custodian)	Consistent indicators so that information collected can be aggregated with state MER reporting. CMA uses to assist LG to report on catchment health at a local scale.
	Marine habitat mapping	yes		(all coastal CMAs)
	Vegetation mapping	yes		to address gaps in state-wide data
	Farmland mapping	yes	DoP	to identify prime farming assets and agricultural land. Two layers for developing regional plans.
	Project-scale monitoring data			

CMA	Data set	Spatially represented	Supplied to	Purpose
Hawkesbury Nepean	Community survey			Conducted in 2008; focus on NRM management, changing issues and trends.
	Seagrass mapping			
Hunter Central Rivers	Soil Watch	yes	OEH - SALIS	CMA baseline data at the project-level, plus sampling every 5 years. SoC reporting (not sure if the data was actually used).
	Native vegetation condition	yes	OEH, landholders	SoC reporting
	Water Watch (community collected)	yes	OEH	Not sure what the data is used for. Difficult to access the data.
	Marine habitat mapping	yes		
	Community data			Community capacity & values; converting to spatial information.
Border Rivers Gwydir	Native vegetation mapping (extent & condition)	yes	OEH	Based on aerial photographs and modelling to fill gaps. High resolution data.
	Water quality	yes	UNE	Intervention-based sites
	Aquatic invertebrates	yes		
	Community attitudes			Used for the delivery of education and training programs.
	Fauna studies	Yes		Preliminary studies in western part of catchment.
	Community survey			
	Vegetation (Practical Partnerships)	yes	OEH	Monitoring at surveillance (control) & intervention sites. OEH has stopped monitoring surveillance sites, however, CMA has continued monitoring intervention sites.
	Soils (Practical Partnerships)	yes	OEH	Monitoring at surveillance (control) & intervention sites. OEH has stopped monitoring surveillance sites, however, CMA has continued monitoring intervention sites.
	Water quality	yes	NOW	Purpose is to integrate state-wide data with monitoring data from intervention sites.
	Culturally Significant Lagoons & Salt-Affected Sites Project	yes		Assessment of Indigenous values of wetlands.

CMA	Data set	Spatially represented	Supplied to	Purpose
Sothern Rivers	Wetland data layer (extent & condition)	yes	Southern Councils Group, LG, DPI, OEH	Compilation of numerous existing datasets. Supplied to LG for planning and identifying works.
	Monaro Grasslands map	yes	OEH, LG	Modelled data. Supplied to LG for land use planning and LEPs.
	Vegetation maps (Shoalhaven and Upper Shoalhaven)	yes		Base layers.
	Riparian vegetation maps	yes		Prepared for half the catchment. Based on modelled and ground-truthed data.
	Aerial photographs (Bega region)			
	Riverstyles			Layer for catchment.
	Acid sulphate soil mapping	yes		Commissioned with Shoalhaven Council
	Social benchmarking survey			Undertaken 5 years ago; applying for funding to repeat.
	LMD	yes	OEH	spatial information on on-ground works. Information used by PVP development team.
Western	Rangeland Assessment Program (RAP)	NO	OEH	Over 20 years of data primarily in relation to vegetation and groundcover monitoring; site-based.
	Vegetation (Practical Partnerships)		OEH	CMA is not certain to what extent the data is used by OEH.
	Soils (Practical Partnerships)		OEH	CMA is not certain to what extent the data is used by OEH.
	Project-based monitoring			Primarily undertaken by participating landholders. Includes photopoints, groundcover, etc, post-intervention.
	Groundcover	yes		CMA is about to commission OEH (John Lees) to assess patterns of groundcover across the catchment.

CMA	Data set	Spatially represented	Supplied to	Purpose
	High conservation area	yes		Contracted DECCW to map high conservation areas in the catchment, however the CMA is concerned about the output due to the limited availability of records that the mapping was based on.
	Feral goats (Kangaroo Management Plan)	?		The CMA discovered (by chance) that the kangaroo surveys conducted to prepare the Kangaroo Management Plan have also been collecting counts of feral goats back to 1992. Goats are a significant issue in the CMA and many strategic decisions and incentive funding are around the management of feral goats. The CMA has now commissioned the DPI to analyse the goat data.
	Social benchmarking survey			Conducted a telephone survey 3 years ago and due to duplicate. Information is used to design the community engagement strategy.
	Hudson Pear and Mescale mapping	yes		
	Wetland survey			
	Riverine condition			
Murrumbidgee	River Reach	yes		Purchasing geomorphologic layer. Data used to build a DST for environmental water management; to predict outcomes from water releases.
	Wetlands (Lowbidgee)	yes		Farm-scale wetland mapping
	Vegetation extent	yes		Based on modelled vegetation data and maps (purchased from other agencies). Continuous GIS data layer for modelling tool inputs. Used by LG for LEPs.
	Social surveys			Involvement in Landcare and interactions with CMA.
Sydney Metro	Wetland map	yes	Manly Council	Rezoning applications to DoP
	Rapid Fauna Habitat Assessment			For ecological assessments.
	Vegetation mapping	yes		to 1:4000 scale

CMA	Data set	Spatially represented	Supplied to	Purpose
	Hydrogeological landscape mapping	yes		Commissioned by CMA; awaiting data.
	Seagrass mapping	yes		Monitoring at 10 year intervals.
	Volunteers	?		Number of bush care volunteers throughout councils in the catchment
Namoi (total of 86 datasets including knowledge reports and spatial data)	Vegetation extent (including re-European)	yes	DoP Local government	Strategic Regional Land use Planning State of the Environment reporting (LG)
	Wetland condition & extent (including priority wetlands)	yes		
	Groundwater dependent ecosystems	yes		
	Floodplain mapping	yes		
	Threatened species	yes		
	Biodiversity assets	yes		
	Soils mapping	yes	Consultants	EIS for land use and land capability
	Social benchmarking (2006 & 2010)			Attitudes & awareness

APPENDIX D

CMA MER DOCUMENTS

The documents listed in Table 8 were identified by CMA officers during the interview. As these documents may support NRC knowledge regarding CMA MER processes and activities copies were requested.

Table 8: Documentation requested from CMAs

CMA	Document title	Received
CW	Central West CMA Evidence Plan (Environmental Evidence Australia, February 2010)	Yes
	Monitoring, Evaluation, Reporting and Improvement Strategy (CW CMA, September 2009)	Yes
HCR	Data library (spreadsheet)	Yes
	CAP Data and Knowledge Plan	Yes
	Hunter-Central Rivers CMA Spatial Data Audit (Ecological, May 2011)	Yes
LMD	No relevant documents identified in the interview	-
HN	Knowledge gaps – knowledge needs register	Yes
	Draft Knowledge Strategy	Yes
SM	Review of the indicators used in the SoC report	No
	Spreadsheet of Licence Agreement Registrations	No
SR	No relevant documents identified in the interview	-
Lachlan	Evaluation report undertaken to assess the impact of investment (performance and condition)	No
	Conservation Grazing Program Evaluation: Final Report August 2011	Yes
Western	Rangeland Assessment Program http://www.environment.gov.au/land/rangelands/acris/index.html.	Yes
BRG	Community Survey	No
NR	Data audit spreadsheet	No
Murray	Spatial Prioritisation Final Report	Yes
	Biodiversity Monitoring Project: Summary for CfoC	Yes
	CfoC Summary MERI Activities	Yes
	Social survey	No
Murrum	No relevant documents identified in the interview	-